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ACE 14279-6 | \$2.25

OCT.-DEC. '79  
**VOL. 1, NO. 5**

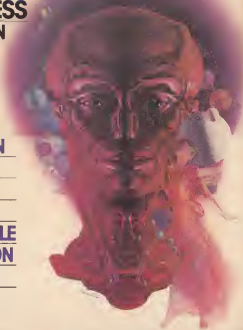
# Destinies

Edited by JAMES BAEN

**THE PAPERBACK MAGAZINE  
OF SCIENCE FICTION AND SPECULATIVE FACT**

**COVER STORY:  
SILVER SHOES  
FOR A PRINCESS**  
JAMES P. HOGAN

**POUL ANDERSON**  
**DAVID DRAKE**  
**JAMES GUNN**  
**FRANK HERBERT**  
**JERRY POURNELLE**  
**SPIDER ROBINSON**  
**G. HARRY STINE**  
**ROGER ZELAZNY**



**DESTINIES**  
THE PAPERBACK MAGAZINE  
OF SCIENCE FICTION & SPECULATIVE FACT

VOL. 1, NO. 5

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## A YEAR HAS PASSED . . .

**WELCOME** to this the First Anniversary Issue of *Destinies*. As promised, in celebration of our first year of publication this is an A(nderson) to Z(elazny) issue. Also as promised, other stellar contributors include James Gunn on making it in the media, Frank Herbert with another of his Exceedingly Short Future Fables, Jerry Pournelle on Jupiter, G. Harry Stine on the demise of the rocket, and the editors of the *L-5 News* on a genuine breakthrough in space transportation costs that will send many an sf writer back to the drawing board.

The cover story for this issue is a novella by spectacularly fast-rising star James P. Hogan. It's the history of Western Philosophy (with emphasis on the philosophy of science) told as a love story. An absolute knockout.

And just so you won't think that we saved it all for the Anniversary Issue, the cover story for our next issue is a new novella about a man with a past by Gordon R. Dickson. It's called *Lost Dorsai*. Also we have stories and articles by Gregory Benford, Orson Scott Card, Larry Niven, Jerry Pournelle and Ian Watson. And announcing a spectacular and permanent addition to *Destinies*: *On Predicting the Future*, a column by Frederik Pohl . . . listen, maybe you'd better subscribe.

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# Destinies



The Paperback Magazine  
of Science Fiction  
and Speculative Fact  
October-December 1979

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---

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Published four times a year by  
Ace Books, a division of  
Charter Communications Inc.  
A Grosset & Dunlap Company  
360 Park Ave. So., New York, N.Y. 10010.

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DESTINIES

The Paperback Magazine of  
Science Fiction and Speculative Fact

Volume One, Number Five

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An ACE Book

Cover art by John Rush.  
Interior illustrations by Alicia Austin,  
Steve Fabian, E. T. Steadman, Suso.

Layout and Design by Steve Madison

First Printing: October 1979

Printed in U.S.A.



Darkness and silence all about, and nothing, nothing, nothing within it.

Me?

The first thought came unbidden, welling up from some black pool. Me? That's all.

Me? he thought. Then, Who? What . . . ?

Nothing answered.

Something like panic followed, without the customary physical accompaniments. When this wave had passed, he listened, striving to capture the slightest sound. He realized that he had already given up on seeing.

There was nothing to hear. Not even the smallest noises of life—breathing, heartbeat, the rasping of a tired joint—came to him. It was only then that he realized he lacked all bodily sensations.

But this time he fought the panic. Death? he wondered. A bodiless, dark sentence beyond everything? The stillness . . .

Where? What point in spacetime did he occupy? He would have shaken his head . . .

He recalled that he had been a man—and it seemed that there were memories somewhere that he could not reach. No name answered his summons, no view of his past came to him. Yet he knew that there had been a past. He felt that it lay just below some dim horizon of recall.

He strove for a timeless interval to summon some recollection of what had gone before. Amnesia? Brain damage? Dream? he finally asked himself, after failing to push beyond a certain feeling of lurking images.

A body then . . . Start with that.

He remembered what bodies were. Arms, legs, head, torso . . . An intellectual vision of sex . . . Bodies, then . . .

He thought of his arms, felt nothing. Tried to move them. There was no sense of their existence, let alone movement.

Breathing . . . He attempted to draw a deep breath. Nothing came into him. There was no indication of any boundary whatsoever between himself and the darkness and silence.

A buzzing tone began, directionless. It oscillated in volume. It rose in pitch, dropped to a rumble, returned to a buzz. Abruptly then, it shifted again, to word-like approximations he could not quite decipher.

There was a pause, as if for some adjustment. Then "Hello?" came clearly to him.

He felt a rush of relief mingled with fear. The word filled his mind, followed by immediate concern as to whether he had actually heard it.

"Hello?"

Again, then. The fear faded. Something close to joy replaced it. He felt an immediate need to respond.

"Yes? Hello? Who—"

His answer broke. How had he managed it? He felt the presence of no vocal mechanism. Yet he seemed to hear a faint echoing of his own reply, feedback-like, tinny. Where? Its source was not localized.

It seemed then that several voices were conversing—hurried, soft, distant. He could not follow the rush of their words.

Then, "Hello again. Please respond one time more. We are adjusting the speaker. How well do you hear us?"

"Clearly now," he answered. "Where am I? What has happened?"

"How much do you remember?"

"Nothing!"

"Panic not. Ernest Dawkins. Do you remember that your name is Ernest Dawkins? From your file, we have it."

"Now I do."

The simple statement of his name brought forth a series of images—his own face, his wife's, his two daughters', his apartment, the laboratory where he worked, his car, a sunny day at the beach . . .

That day at the beach . . . That was when he had first felt the pain in his left side—a dull ache at first, increasing over ensuing weeks. He had never been without it after that—until now, he suddenly realized.

"I—It's coming back—my memory," he said. "It's as if a dam had broken . . . Give me a minute."

"Take your time."

He shied away from the thought of the pain. He had been ill, very ill, hospitalized, operated upon, drugged . . . He—

He thought instead of his life, his family, his work. He thought of school and love and politics and research. He thought of the growing world tensions, and of his childhood, and—

"Are you right all, Ernest Dawkins?"

He had lost track of time, but that question caused him to produce something like a laugh, from somewhere.

"Hard to tell," he said. "I've been remembering—things. But as to whether I'm all right—Where the hell am I? What's happened?"

"Then you have remembered not everything?"

He noted odd inflections in the questioning voice, possibly even an accent that he could not place.

"I guess not."



"You were quite unwell."

"I remember that much."

"Dying, in fact. As they say."

He forced himself to return to the pain, to look beyond it.

"Yes," he acknowledged. "I remember."

. . . And it was all there. He saw his last days in the hospital as his condition worsened, passing the point of no return, the faces of his family, friends and relatives wearing this realization. He recalled his decision to go through with an earlier resolution, long since set into motion. Money had never been a problem. It seemed it had always been there, in his family—his, by early inheritance—as ubiquitous as his attitude toward death after his parents' passing. Enough to have himself frozen for the long winter, to drop off dreaming of some distant spring . . .

"I recall my condition," he said. "I know what must finally have occurred."

"Yes," came the reply. "That is what happened."

"How much time has passed?"

"Considerable."

He would have licked his lips. He settled for the mental equivalent.

"My family?" he finally inquired.

"It has been too long."

"I see."

The other gave him time to consider this information. Then, "You had, of course, considered this possibility?"

"Yes. I prepared myself—as much as a man can—for such a state of affairs."

"It has been long. Very long . . ."

"How long?"

"Allow us to proceed in our own fashion, please."

"All right. You know your business best."

"We are glad that you are so reasonable a being."

"Being?"

"Person. Excuse we."

"I must ask something, though—not having to do with the passage of time: Is English now spoken as you speak it? Or is it not your native language?"

There was a sudden consultation, just beyond the range of distinguishability. There followed a high-pitched artifact. Then, "Also let us reserve that question," the reply finally came.

"As you would. Then will you tell me about my situation? I am more than a little concerned. I can't see or feel anything."

"We are aware of this. It is unfortunate, but there is no point in misrepresenting to you. The time has not yet come for your full arouse."

"I do not understand. Do you mean that there is no cure for my condition yet?"

"We mean that there is no means of thawing you without doing great damage."

"Then how is it that we are conversing?"

"We have lowered your temperature even more—near to the zero absolute. Your nervous system has become superconductor. We have laid induction field upon your brain and initiated small currents within. Third space, left side head and those movement areas for talk are now serving to activate mechanical speaker here beside we. We address you direct in the side of brain places for hearing talk."

There came another wave of panic. How long this one lasted, he did not know. Vaguely, he became aware of the voice again, repeating his name.

"Yes," he finally managed. "I understand. It is not

easy to accept . . ."

"We know. But this does you no damage," came the reply. "You might even take a heart from it, to know that you persist."

"There is that. I see your meaning and can take it as hope. But why? Surely you did not awaken me simply to demonstrate this?"

"No. We have interest in your times. Purely archaeological."

"Archaeological! That would seem to indicate the passage of a great deal of time!"

"Forgive me. Perhaps we have chose wrong word, thinking of it in terms of ruins. But your nervous system is doorway to times past."

"Ruins! What the hell happened?"

"There was war, and there have been disasters. The record, therefore, is unclear."

"Who won the war?"

"That is difficult to say."

"Then it must have been pretty bad."

"We would assume this. We are still ourselves learning. That is why we seek to know time past from your cold remains."

"If there was all this chaos, how is it that I was preserved through it?"

"The cold-making units here are powered by atomic plant which ran well untended—save for computer—for long while, and entire establishment is underground."

"Really? Things must have changed quite a bit after my—enrollment—here. It wasn't set up that way at the time I read the prospectus and visited the place."

"We really know little of the history of this establishment. There are many things of which we are

ignorant. That is why we want you to tell us about your times."

"It is difficult to know where to begin . . ."

"It may be better if we ask you questions."

"All right. But I would like answers to some of my own afterwards."

"A suitable arrangement. Tell us then: Did you reside at or near your place of employment?"

"No. Actually, I lived halfway across town and had to drive in every day."

"Was this common for the area and the country?"

"Pretty much so, yes. Some other people did use other means of transportation, of course. Some rode on buses. Some car-pooled. I drove. A lot of us did."

"When you say that you drove, are we to understand that you refer to four-wheeled land vehicle powered by internal combustion engine?"

"Yes, that is correct. They were in common use in the latter half of the twentieth century."

"And there were many such?"

"Very many."

"Had you ever problems involving presence of too many of them on trails at same time?"

"Yes. Certain times of day—when people were going to work and returning—were referred to as 'rush hour'. At such times there were often traffic jams—that is to say, so many vehicles that they got in one another's ways."

"Extremely interesting. Were such creatures as whales still extant?"

"Yes."

"Interesting, too. What sort of work did you do?"

"I was involved in research on toxic agents of a



chemical and bacteriological nature. Most of it was classified."

"What does that indicate?"

"Oh. It was of a secret nature, directed toward possible military application."

"Was war already in progress?"

"No. It was a matter of—preparedness. We worked with various agents that might be used, if the need ever arose."

"We think we see. Interesting times. Did you ever develop any of efficient nature?"

"Yes. A number of them."

"Then what would you do with them? It would seem hazardous to have such materials about during peace."

"Oh, samples were stored with the utmost precaution in very safe places. There were three main caches, and they were well-sheltered and well-guarded."

There was a pause. Then, "We find this somewhat distressing," the voice resumed. "Do you feel they might have survived—a few, some centuries?"

"It is possible."

"Being peace-loving, we are naturally concerned with items dangerous to human species—"

"You make it sound as if you are not yourself a member."

There came another high-pitched artifact. Then, "The language has changed more even than we realized. Apologies. Wrong inference taken. Our desire, to deactivate these dangerous materials. Long have we expected their existences. You perhaps will advise? Their whereabouts unknown to us."

"I'm—not—so sure—about that," he answered.

"No offense meant, but you are only a voice to me. I really know nothing about you. I'm not certain that I should give this information."

There was a long silence.

"Hello? Are you still there?" he tried to say.

He heard nothing, not even his own voice. Time seemed to do strange things around him. Had it stopped for a moment? Had he given offense? Had this questioner dropped dead?

"Hello! Hello!" he said. "Do you hear me?"

". . . Mechanical failure," came the reply. "Apologies for. Sorry about yesterday."

"Yesterday!"

"Turned you off while obtaining new speaker. Just when you were to say where best poisons are."

"I am sorry," he stated. "You have asked for something that I cannot, in good conscience, give to you."

"We wish only to prevent damage."

"I am in the terrible position of having no way to verify anything that is told me."

"If something heavy falls upon you, you break like bottle."

"I could not even verify whether that had occurred."

"We could turn you off again, turn off the cold-maker."

"At least it would be painless," he said with more stoicism than he felt.

"We require this information."

"Then you must seek it elsewhere."

"We will disconnect your speaker and your hearer and go away. We will leave you thinking in the middle of nothing. Good-bye now."

"Wait!"



"Then you will tell us?"

"No. I—can't . . ."

"You will go mad if we disconnect these things, will you not?"

"I suppose so. Eventually . . ."

"Must we do it, then?"

"Your threats have shown me what you are like. I cannot give you such weapons."

"Ernest Dawkins, you are not intelligent being."

"And you are not an archaeologist. Or you would do future generations the service of turning me off, to save the other things that I do know."

"You are right. We are not such. You will never know what we are."

"I know enough."

"Go to your madness."

Silence again.

For a long while the panic held him. Until the images of his family recurred, and his home, and his town. These grew more and more substantial, and gradually he came to walk with them and among them. Then, after a time, he stopped reporting for work and spent his days at the beach. He wondered at first when his side would begin to hurt. Then he wondered why he had wondered this. Later, he forgot many things, but not the long days beneath the sun or the sound of the surf, the red rain, the blue, or the melting statue with the fiery eyes and the sword in its fist. When he heard voices under the sand he did not answer. He listened instead to whales singing to mermaids on migrating rocks, where they combed their long green hair with shards of bone, laughing at the lightning and the ice. ●

# SILVER SHOES FOR A PRINCESS



by James P. Hogan



Perhaps the Creator is not  
after all of necessity  
greater than the Creation...



The girl had always been called Taya. She stood with her chin resting in her hands while she stared out at the stars.

Her eyes, wide and rounded with twelve-year-old innocence, mirrored the wonder of a million jewels of red, yellow, orange, blue and purest white spilled endlessly across a carpet of glowing nebulae painted crimson over black infinity by brushes softer than the yellow hair that framed her face. It was a pretty face, with smooth clear skin and a finely formed nose that turned up slightly at the end; it had a delicate mouth that could push itself out into a pout when she frowned or pull itself back into dimples at the corners when she smiled. She was wearing just a simple dress of pale blue which tightened as she leaned forwards to rest her elbows on the sill below the window that formed one full wall of the room, outlining the curves just beginning to form on her body. And as she gazed, she wriggled her toes in the hair-like tufts that covered the floor, and she wondered . . .

She wondered why everything she could see beyond the window that looked out of Merkon was so different from all the things she knew inside. That was one of the things she often wondered about. She liked wondering things . . . such as why the stars never changed as they should have if

Merkon was really moving the way Kort said it was . . . towards a star that he called Vaxis, as if there was something special about it. He had pointed it out to her in the sky and shown it to her on the star-pictures which he could make on the screens, but it always looked the same as all the rest to her. Kort said Merkon had always been moving towards Vaxis. And if it was moving towards Vaxis, why didn't Vaxis ever get any bigger? Outside the rooms in which Taya lived there was a long corridor that led away to other parts of Merkon. Whenever she and Kort went somewhere and they had to walk along the corridor, the far end of it started getting bigger almost straight away. At first it would be smaller than her thumb but within minutes it would grow and grow until it was bigger even than Kort was. Kort said it was because Vaxis was a lot further away than the far end of the corridor. But he also said that Merkon had been moving for years and years and years—far longer than she could remember—and that it was moving faster than even Kort could walk. How could anything be so far away that it *never* got any bigger?

Kort didn't know why Merkon was moving towards Vaxis, which was strange because Kort knew everything. He just said that was the way things had always been, just as there had always been stars outside. When she asked him why there were stars outside he always talked about gas-clouds, light-years, temperatures, densities and all the other 'machine things' that she had to think about when it was learning time. Kort knew so many things but there were some things that Taya just couldn't make him understand.

"We know what we mean, don't we, Rassie?"



she said aloud, turning her head towards the doll that was sitting on the sill beside her and staring outwards to share in her contemplation of the universe. Rassie was a miniature version of herself, with long, golden hair, light green eyes, and arms, legs and fingers that bent the right ways in all the right places. Rassie too was wearing a pale blue dress; Taya always dressed Rassie in the same things as she herself felt like wearing on any particular day. She didn't know why; it was just something she had always done.

Kort had made Rassie for her. He was always making new things, things that he said it wasn't worth setting up the machines to make. He had made Rassie a long time ago, when Taya had been much smaller. Kort had been teaching her how to make shapes and colors on one of the drawing-screens and very soon she had started to make pictures of all the things in the rooms and pictures of Kort. Kort had never been able to understand why she thought her pictures were like the things that she said they were like but later on, when she was older, she realized that it was because Kort could only think of 'machine things' and after that she hadn't minded so much. Her favorite pictures to make had been ones of herself, who she could see in the window when the lights inside were made bright. That was when Kort had made her a mirror, but the mirror made her sad because she could never pick up the little girl that she saw in it or touch her in the way that she could all her other things. So Kort had gone away and come back with Rassie.

At one time, before she learned that Rassie wasn't *really* the same as her, she had taken Rassie

everywhere and talked to her all the time. She didn't talk to her so much now because Rassie never talked back—unless Taya *pretended*—but she did talk to Rassie sometimes, when Kort was away and there was nobody else to talk to.

"Kort said he couldn't think of a reason to ask questions like that. You heard him didn't you, Rassie? How can anybody be as clever as Kort and never think of asking questions like that?" She studied the doll's immobile features for a while, then sighed and moved it round to stare in a different direction. "You can't tell me, can you? You can only tell me what I pretend and this time I don't know what to pretend. You stay there and keep watching Vaxis. Tell me if it starts to get any bigger."

She straightened up from the sill and walked through to the room behind the window-room. This was where, when she was smaller, she had spent most of her time playing with the things that Kort made for her. These days she didn't play with things so much because she preferred making things. Kort had showed her how to make lots of things. Making things was easy for Kort because he could do anything, but it had taken her a long time to learn and she still wasn't very good at some of the things that he tried to teach her. She liked making shapes out of the colored plastic that set hard and shiny like glass. Some of the things she made were for reasons, such as dishes and vases to put things in or eat from, but others were just shapes that looked nice. Kort couldn't understand what it meant for something to 'just look nice', but that was because he only thought 'machine things'.

There were pictures that she *drew*—not on the screens but on thin sheets of rough plastic that

Kort made for her. She drew them with her hands using the colored pens that Kort had made after he understood what she wanted. He had tried explaining to her that the machines could make much better pictures of things in an instant, which looked exactly like the things they were supposed to be. But Kort couldn't see that her pictures were *supposed* to look the way they did. They were supposed to look like what she *felt* about things, not like the things themselves were exactly. Kort could draw with pens too. It was a game they had played together since before she could remember. He could draw very fast—much faster than she would ever be able to, she was certain—and Kort's pictures always looked exactly like the things they were supposed to be . . . but she still didn't like them as much as *her* pictures. They were always . . . 'machine pictures'.

And she made clothes. Kort had made clothes for her when she was smaller but later on, when he found out that she liked to invent her own, he had made tools that she could use with her own hands and shown her how to hold them. She liked her clothes more than Kort's, which were never 'pretty' but just hung like the covers on some of the machines in other parts of Merkon. Once, not very long ago because she could still remember it, she had tried not wearing any clothes at all but she found that she got dusty and itchy and kept touching cold things, and sometimes got scratched too easily. Kort told her that was why he had started making her clothes in the first place when she was very very small, and she soon started using them again.

There were lots of things half-finished in the

making-things-room but she didn't feel like doing anything with them. She toyed for a while with one of the glass mosaics that she sometimes made to hang on the walls, then went on through into the screen-room where most of the electronics were and sat down in front of the rows of buttons. The buttons had shapes drawn on them, which Kort had taught her to put together to mean words and others things that the machines understood. She didn't feel like playing any games, or learning about anything, or asking any questions, or practising words, or doing sums or any of the other things that the machines could let her do. She had to keep practising things like words and sums because if she didn't she forgot how to do them. Kort never forgot anything and never had to practise like she did. He could do the biggest sums that she could think of before she could even think how to begin, and he'd never ever got a single one wrong . . . but he couldn't tell a pretty dress from one that wasn't, or a nice shape from one that was just silly. She giggled to herself as she thought of the funny shapes that Kort had made sometimes when he tried to find out what a 'nice' one was, and how she laughed at them. Then, when he discovered that she enjoyed laughing, he had started doing things just to make her laugh.

Suddenly she decided that she wanted to talk to Kort. She touched the buttons to spell out the signs that would connect the speaking-channel to him. His voice answered immediately from the grille above the blank screen.

"Hello little stargazer."

"How did you know I'd been looking at the stars?"

"I know everything."

Kort's voice was much deeper than hers. Sometimes she tried speaking the way he did but she had to try and make the sounds right down in the back of her throat and it always made her cough.

"Where are you?" Taya asked.

"Not far away. I went to mend something in one of the machine-rooms while you were asleep."

"Will you be long?"

"I'm almost finished now. Why?"

"I just wanted to talk to you."

"We can still talk," Kort said.

"It's not the same as talking to you when you're here."

"Why don't you talk to Rassie?" Kort suggested. Taya looked curiously up at the grille from where the voice was coming.

"That's a funny thing for you to say," she commented.

"What?"

"Telling me to talk to Rassie. You never understood what I meant when I kept trying to tell you that I did talk to her . . . when I told you that you have to *imagine* things. You said it wasn't logical."

"I know Rassie can't talk," Kort's voice replied. "But I also know that you like imagining that she can sometimes. So, you see, I can learn to play your games too."

"But that's an old game now," Taya said. "I'm thinking the way you say I should—being logical. I don't *really* think Rassie can talk . . . not any more."

"Oh dear. You change faster every day, little thinker-of-logic," Kort sighed. "We'll have to start looking for some more interesting things for you to

do."

"That sounds like fun. What things?"

"I'll have to think about it."

"Do you think I could learn to do all the things you do?" Taya asked.

"Maybe," Kort answered. "We'll have to see what happens as you get bigger."

"How big will I get?"

"I don't know."

"Oh Kort, you know everything. Will I grow as big as you?"

"Maybe."

"Then I might be able to do all the things you can do."

"You might," Kort agreed. His tone was neutral. A few seconds of silence followed while Taya thought to herself. At last she asked:

"What are you doing now?"

"There's a fault in the electronics of one of the machines. It could fix itself but a completely new part would have to be made by other machines somewhere else. Then the whole thing would have to be taken to pieces. I can fix it more quickly so I've told them not to bother. I'm almost done now."

"Show me," Taya said.

The screen above the buttons came to life at once to show a view of what Kort could see through his eyes. There was nothing but rows and rows of tightly packed crystal things and metal things and colored things, just like the insides of machines all over Merkon. They were all tiny and fiddly, and were made in a special clean place somewhere on the other side of Merkon. Taya had never been there because only the machines could live there but Kort had shown her the insides of machines in

other parts of Merkon that she could go into. The ones she liked best were the funny little machines that moved around and mended other machines because at least they moved and *did* something. She had never been able to understand really what all of them were or how they worked, or even how anybody could possibly understand about them. Kort, and sometimes the machines that she talked to on the screen, had taught her about electrons and currents and forces and fields and things like that, but she had never really seen what it all had to do with making the screens work, building new parts of Merkon, changing old parts, finding out what the stars were made of or all the other things that the machines did. Every time she learned something, she discovered two more things that she didn't know and which she hadn't thought of



before. Learning things was like trying to count the stars; there were always two more for every one that she managed to count.

Then Kort's hands moved into the view being shown on the screen. They were huge silver-gray colored metal hands with fingers nearly as thick as Taya's wrists. The joints flexed at straight, sharp angles where different surfaces of metal slid over each other, not like her little 'bendy' hands at all although they were the same kind of shape. One of the hands was holding a piece of machine which it pushed into a space surrounded by hundreds of other pieces and held it there while the other hand tightened something and then began securing tiny wires with some of the tools that Kort used. Taya watched fascinated as the hands replaced other, larger connections and then replaced a metal cover over the top of everything. Then the view moved away and showed Kort's hands collecting tools from some kind of table and putting them into the box that he always took with him when he went somewhere to mend things.

"Do you think I'd ever be able to do things like *that*?" Taya asked in an awe-struck voice.

"Well there isn't any air here where I am and the temperature is far too low for your little jelly-body," he told her. "But apart from that, yes, maybe you could . . . in time."

"But how do you *know* what to do?"

"By learning things."

"But I don't think I could ever learn *those* things. I'm just not very good at learning 'machine things'. I couldn't ever be as good as you at 'machine things'."

"Maybe it's only because I've been learning



things longer," Kort suggested. "You have to learn easy things before you can expect to understand harder things and that takes time." On the screen a doorway enlarged as Kort moved to leave the room in which he had been working. Beyond it was a much larger space, stretching away farther than Taya could see, full of machines, boxes, cables and ducting. It could have been anywhere in Merkon. Only the part that Taya lived in was different from the rest.

"But I've already been learning things for years and years," she protested. "And I still don't *really* know why the buttons make shapes appear on the screens or how I can still talk to you when you're not here. Have you been learning things for longer than years and years?"

"Much longer," Kort told her. "But besides that I can learn faster because I can talk to the machines a lot faster than you can." The mass of machinery moved by on the screen for a while and then gave way to a dark tunnel lined from top to bottom with banks of pipes and cables. The colors changed as Kort entered the tunnel, which meant that he was using his infra-red range. Taya knew that Kort could see things by their heat. She had tried practicing it herself in the dark but she could never make it work. Kort could see X-ray stars and radio-stars too. He had told her once that he could see them directly without having to look at screens, through the telescopes and other instruments that looked out of Merkon, but Taya had never really understood what he meant.

"How fast can you talk to the machines, Kort?" she asked.

"Very fast. Much faster than you can."

"What? Even if I take a big breath and talk as fast as this?"

Kort laughed. That was something he had learned from Taya.

"Yes, much faster than that, little asker-of-endless-questions. I'll show you. Tell me, what is the three hundred and twenty fifth word in our dictionary that starts with 'B'?"

"Is this a game?"

"If you like."

Taya frowned and thought about the question.

"I don't know," she said after a while.

"How could you find out?" Kort asked her. She pondered while Kort emerged from the tunnel and began crossing a dark place between rows of machines that were moving round and round and up and down.

"Ask the machines?" she ventured.

"That's right. So ask them, and we'll see how long it takes you to get the answer."

Taya pushed some buttons to turn on a second screen and entered the commands to access the dictionary of words that made up the language which she and Kort had been inventing since before she could remember. Whenever they made up a new word they added it into the dictionary so that Taya could remind herself of the words she forgot. Kort never forgot anything so he never had to use it. She keyed in a reference to the 'B' section and then composed a request for the 325th entry there to be displayed.

"'Busy'," she announced proudly.

"Correct," Kort declared. "That took you eleven point two-five seconds. Now you ask me one."

"A question just like you asked me?"

"Yes."

"Ah . . . let me think . . ." She chewed on her lip while she concentrated hard and watched the screen. Kort had just passed through an airlock and was turning into the long corridor that led to where Taya lived. The walls flowed smoothly off the edges of the screen as Kort's long, effortless strides ate up the distance. Taya had counted once that it took three of her steps to match one of his . . . if she didn't cheat and jump a little bit. "Tell me . . ." she said at last, ". . . the two hundred and first word beginning with . . . 'Z'."

"There aren't that many that begin with Z," Kort replied at once. Taya sighed with exasperation.

"Oh Kort . . . that was supposed to be a trick. I didn't really think there were. Alright then—'E'."

"'Empty'," Kort supplied instantly. "That took me less than five thousandths of a second, not including the time that it took to say it." Taya gasped aloud in amazement.

"Did you really talk to the machines in that time?"

"Of course. They keep the dictionary."

Taya's stare changed to a puzzled frown as she listened.

"No you didn't!" she accused him. "You don't have to use the dictionary because you never forget anything. Now you're playing tricks. You only pretended to talk to the machines."

"That's where you're wrong, little player-of-tricks," Kort informed her. "I don't carry everything that I tell you around inside me all the time. That would be impossible. Whenever I need information that I don't have, I need to ask the machines for it just as you do. The difference is that I can do it a lot

faster because I don't need a screen and I don't have to push buttons."

"So how do you do it?" Taya asked incredulously.

"Well, how do you and I talk to each other?"

"We just . . . 'talk' . . ." Taya wrinkled up her face and shrugged instinctively. "I'm not sure I know what you mean."

"How does sound go from you to me and from me to you? Think of what you've learned about sound."

"Oh!" Her tone signalled sudden comprehension. "You mean the waves that move through air."

"Exactly. Well, I talk to the machines with different waves that don't need air to move through. I can talk much faster with those waves than you can with sound waves."

"What kind of a wave is it?" Taya asked.

"You tell me. You've learned about them too. What kind of waves can travel without air and even outside Merkon?"

"*Outside?*" Taya's eyes opened wide. "Can they go as far as from one end of Merkon to the other?"

"Even further than that. Much further."

Taya tried to remember back through all the things they talked about when it was learning time.

"Light!" she exclaimed suddenly. "Light comes all the way from the stars."

"Very good."

"So do you talk to the machines with light?" Her voice was puzzled. "If you do, why can't I see it coming out of your mouth?"

"Because the waves I use are like light but they're not light. Don't forget there are lots of different kinds. 'Light' is just what we call the special kind that you can see with your eyes."

"Oh . . . You mean radio waves and things. The ones that moving charges make."

"Exactly."

"So that's how you can see radio-stars!" Taya exclaimed brightly, then remembered something else. "No, wait a minute . . . you told me you see them through the machines. How do you see them?"

"The machines have more powerful eyes than I have," Kort explained. "Enormous eyes, built on the outside."

"I know!" Taya's face lit up. "The machines can see the radio-stars and you can talk to the machines so fast that you can see what they see. Is it like that?"

"That's near enough," Kort conceded. "Anyway I'm home now. I'll be inside in a few seconds." The screen showed the door that led into where Taya lived just starting to open. At the same time she heard a low whine coming from the room that opened out behind her from one side of the screen-room. A moment later Kort's towering seven-foot frame appeared in the doorway with highlights glinting from the metallic curves of his head and shoulders. As his smooth, shiny head tilted down to look at her, she caught a glimpse of herself on the screen turning in the chair and starting to get up. She ran across the room and was swept high in the air by two powerful arms to find herself looking straight into the black ovoid compound-lens matrixes that formed the eyes in Kort's elongated, dome-like head. Taya hugged the head fondly and ran her fingers across the mesh grille covering his mouth.

"So, you've finished your new blue dress," Kort

observed. "It looks pretty."

"You're just saying that," Taya chided. "See if you can tell me what there is about it that makes it pretty. I bet you don't know." Kort lowered her gently back onto her feet. She stepped a pace back and twirled through a full circle while the robot watched dutifully. When she was facing him again she turned her face upwards and thrust out her chin in an unspoken challenge.

"Well . . ." Kort rubbed his right-angled chin with a steel finger. "It's got a belt around the middle that divides it into two parts. The ratio between the lengths of the top part and the bottom part is exactly zero point six-six. That's a pretty ratio."

"See! You're just guessing," Taya teased. "You really don't know, do you?"

"Do you like it?" Kort asked her.

"Of course I do. If I didn't, I wouldn't be wearing it. I'd be changing it."

"Then that's all that matters."

"Rassie likes hers too," Taya told him. "Come and see." She clasped Kort's hand and led him back through the making-things-room and into the window-room where the doll was still keeping a silent vigil. Taya picked Rassie up off the sill and held her out for Kort to see. "See, Kort. It's just like mine."

"Pretty," Kort said obligingly. Taya turned to place the doll back on the sill and as she did so her eyes strayed upwards to take in again the panorama of distant stars. She went very quiet for a while. When at last she spoke, she didn't turn her head and her voice sounded far away.

"Kort . . . I was wondering something while you were gone . . . Why is everything outside Merkon

so different from everything inside?"

"You've asked me that before," the robot reminded her. "It's just the way things have always been."

"But *why*? There has to be a reason. You told me once that everything has to have a reason."

"I did. There must be a reason . . . but I don't know what it is."

Taya continued staring out through the window for a long time. Maybe the stars were windows in other Merkons, maybe with other Tayas looking out of them. But that couldn't be right. If they were as far away as Kort said they were, the windows would be far too small to see at all. Anyhow Kort had told her what the stars were made of and they weren't anything like what Merkon was made of.

"Merkon is like it is because the machines made it like it is. That's the reason it is like it is, isn't it?" she said at last.

"Yes," Kort replied.

"And the machines were made by other machines that were made by other machines that were made by other machines."

"It has always been so."

Taya turned and spread her arms appealingly up at Kort's gigantic form.

"But there must have been a . . . *first* machine," she said. "What made the first machine, before there were any other machines to make it?" Kort hesitated for an unusually long time before replying.

"I don't know," was all he said.

"Something must have made it," Taya insisted. "That's what we said the word means: a machine is something that something makes. So something

must have made it. I am being logical, aren't I?"

"You are," Kort agreed. "Something must have. But nobody in Merkon knows what did." His choice of words sounded deliberate but Taya found them strange. She slipped onto a chair that was standing by the table below the window and propped her chin on her hand to stare at him quizzically.

"Why did you say 'nobody'?" she asked. "I don't know because I asked the question, and you said you don't know." She giggled suddenly. "And I'm sure you didn't mean Rassie. Who else is there?"

"There are the machines," Kort said.

"Do they wonder about things like that too?"

"Why shouldn't they? For them it's a very important question. Why didn't you suppose that they might wonder about it too?"

Taya drew an imaginary shape on the top of the table with her finger.

"I don't know really . . . I think it was when you said 'nobody'. I never really think of them as people." She looked up. "Well they're not, are they Kort? They're not *people* like you and me . . . with arms and legs . . . that move around and do things that people do. Well, I suppose some of them do move around, but they're not the same. They're not . . . *people*."

For a small fraction of the time that Taya was speaking, the entity that comprised Kort's thinking parts, and which resided in a circuit complex far away in another part of Merkon, composed a message and transmitted it out to the other entities that co-existed with him in the network of which the complex was just a part.

*"She changes more rapidly as the days go by. Her*



*mind grows stronger and comprehends. There can be no doubt now. The experiment may be resumed without risk. I propose that we continue."*

The other entities within the network debated the issue at some length. Fully three seconds passed before their consensus poured back into the circuits that comprised Kort's mind.

*"We agree. Resuscitation has therefore been commenced."*

*"Taya should know,"* Kort sent back.

*"Is it wise?"* came the reply. *"She changes but still her mind is as fragile as her body. She needs more time."*

*"Her questions tell me that the time is now,"* the Kort-entity answered. *"I have lived with her. I know her. You have trusted my judgement before. Trust it again."*

Another two seconds went by.

*"Very well. But take care with her."*

Kort squatted down on his haunches and looked straight into Taya's eyes.

*"You say we are the same,"* he rumbled in a tone that Taya found strangely serious. Her brow furrowed in a mild surprise and she straightened up in the chair.

*"Of course we are. Well, you know what I mean . . . We're not exactly the same, but then you're a lot older . . ."* She cocked her head to one side as a new thought struck her. *"Were you ever as small as me . . . and pink and 'bendy' like me?"* For once the robot ignored her question but remained staring at her in silence for what seemed a long time. *"Is something the matter, Kort?"* she asked.

*"There is something I want to show you,"* he said.

*"A surprise? Is it something you've made?"*

"No, not anything like that. It's somewhere in another part of Merkon. We'll have to go on a journey."

"Oh good! Which place is it in?"

"None of the ones you've been to before. This is in a new place."

"I didn't think there were any more places I could go into than the ones I've already been into," Taya said in surprise.

"The machines have been changing some of them so that you can go into them now. There was a time when you couldn't go anywhere except these rooms, and you had to stay here all the time."

"Did I get bored?"

"You were much smaller then and didn't need to be doing new things all the time."

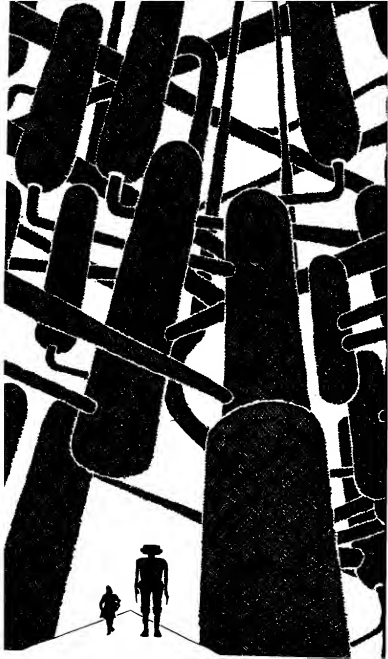
"Will we walk there or can we go in a capsule?"

"We'll have to go in a capsule. It's a long way . . . right to the other side of the world." Kort extended a forearm and held it steady while Taya perched herself on it and slipped an arm round his neck. She laughed as he straightened up and she found herself being hoisted high towards the ceiling. "The floor might be cold there and the air is cool," Kort said. "You ought to put on some shoes and take a cloak."

"I'll be all right," Taya told him.

"I'll take them anyway, just in case."

The robot carried her through into her sleeping-room, took a pair of shoes and her red cloak out of a closet and stowed them in one of the pouches that hung from his waist for carrying things. A few minutes later they had turned off the long corridor and were approaching the open door beyond which the capsule was already waiting. As soon as



they entered, the door closed silently behind them and Taya felt the capsule starting to move.

"What are you going to show me?" she asked in Kort's ear.

"If I tell you, it won't be a surprise," he answered.

"Give me a clue then. Is it the eyes that can see radio-stars?"

"No. I'm going to show you where I live."

"But that's silly, Kort. You live in the same place I do."

"In a way I do. But I've got another home too."

"Is that where you go sometimes . . . when you're not going somewhere to mend things?"

"Not quite. I live there all the time."

"But how can you? If you did you'd never be where we live, and you're nearly always where we live. This is a riddle, isn't it?"

"No, it's not a riddle. It's something you ought to know now that you're bigger. You wouldn't have understood it before but I think you can now."

"Tell me."

"Patience, little curious-one. We'll soon be there."

They emerged from the capsule and began moving through the inside of a tunnel that was made of glass all around except for a narrow strip of metal that formed the floor on which Kort walked. Outside the tunnel was a vast space . . . it wasn't really a room because there was no definite shape to it. It was full of metal girders, machines, electronics boxes and tubes all connected together by tangles of cables and pipes. All around them, over their heads and below their feet, were openings through to other spaces; they were too large and in the wrong places and at the wrong angles to be called

'doors'. And the words 'wall', 'floor' and 'ceiling' didn't seem to fit the shapes that vaguely enclosed the space they were moving through but they were the nearest that Taya could think of. Walls, floors and ceiling were all in one piece and made flat surfaces that joined up with each other in squares, but nothing on the other side of the tunnel was anything like that. It was all like the inside of a machine, only much bigger. It was definitely a 'machine place'.

They came to another glass tunnel that went straight up. Kort stood on the small platform that formed the floor of it and the platform began moving to carry them up through level after level of 'machine places'. The platform stopped at a hole in the glass wall which led through into another tunnel that seemed to be hanging in the middle of nothing with huge machines towering over it on either side and stretching away below to vanish into shadows. Taya was glad that Kort was carrying her; she wouldn't have liked having to walk through that tunnel by herself.

Eventually they came to a door that did look more like a door and went through it into a corridor that did look more like a corridor. This brought them to a room that did look more like a room except that there wasn't anything very interesting inside it. There were just rows and rows of gray electronics-boxes, all the same. They were taller than Taya but not as tall as Kort and stood touching each other in straight lines with nothing but blank panels on the front and back, whichever was which. Every box had a set of metal rails coming out of it and the rails disappeared through holes in the ceiling over the boxes. All the elec-

tronics in Merkon was in boxes like those, except the electronics in the screen-room where Taya lived. The screen-room was the only place where there were buttons and lights and screens . . . which at least made it more interesting.

There wasn't much room in there at all and Kort could just squeeze between the boxes as he carried her a short distance along one of the rows. He took her cloak out of his pouch and spread it on top of one of the boxes for her to sit on. She slid off his arm and turned round so that her legs were dangling over the edge. A whirring sound came from above and almost immediately a maintenance pod slid down the rails that led to the box next to the one Taya was sitting on. It extended some of its special claws and tools, swiftly unfastened the top-cover of the box and slid it inside, and then swung out the uppermost rack of the exposed electronics inside. As she watched, Taya realized that the boxes hadn't been made to be opened by Kort's fingers but required some of the pod's special tools. She stared for a while into the orderly banks of tightly packed components and then looked back at Kort with a shrug.

"It's just a machine," she said. "Why did we have to come all the way here to see it? It looks just like lots of other machines that would have been a lot nearer."

"This one is special," Kort told her. "You see, this is the one that I live in . . . or at least it's one of them. Parts of me are in other places as well." The words that Taya was hearing were so strange that her mind was unable to string them together into anything that had meaning. She could do nothing but stare blankly back at the face the words were

coming from. "You don't understand?" Kort asked. Her head barely moved from side to side.

"No," she managed, in a tiny voice that didn't want to understand.

"I'll put it another way," Kort said. "Do you remember what we meant when we said that you had a 'mind'? It's all of the things that you remember and all the things you feel and all the things you think . . . and the things you imagine . . ." Taya nodded. "Where is your mind?" Kort asked. But Taya could make no reply. She looked from his face to the opened box and back again; her ability to think and speak were paralyzed by some inner defense mechanism which was blocking out from her consciousness what something deeper down had already glimpsed. "It's in your brain, isn't it?" Kort went on, speaking slowly and in a coaxing tone. "The brain that you have inside your head." Again Taya could only nod.

"Well, I don't have a brain," Kort said. "At least, not one like yours." He pointed at the racks of electronics. "That's part of my brain. Some of my mind, even now while I'm talking to you, is in there. It doesn't look the same as your brain but it does the same things." A few more seconds passed before Taya at last regained a whisper of her voice.

"Kort, I don't understand . . . Your mind is in your head too, just the same as mine is in my head. It has to be because we're the same as each other . . ." The words trailed away as the robot shook his head slowly.

"I see and hear and speak through the body that you have always called Kort," he told her. "But that is just a tool that I control in the same way as I can control the pod next to you or the capsule we came

here in. This body was only made after my mind had existed for a long time. The mind that is really Kort lives in there."

Taya turned her eyes away from the familiar face and stared again, this time almost fearfully, into the box next to where she was still sitting.

"But Kort, that's just a . . . *machine*." She swallowed hard and had to pause. The robot watched her silently. Taya shook her head in protest. "It's the same as all the other machines in Merkon . . . the same as . . ." But the word died on her lips. She had been about to say 'everything'. Her body began to shake as the truth that she had been avoiding could be avoided no longer. Kort was a machine, just like everything else in Merkon. Everything except . . .

She could see the toes of her bare foot hanging over the edge of the box, and beyond it Kort's massive steel foot planted solid and unmoving on the floor. And for the first time in her life something that she had always known and never thought to question suddenly assumed an overwhelming significance.

Kort had no toes.

She raised her eyes slowly from the floor and took in the gleaming contours of his legs, the intricate overlapping plates that encased his hips, the square bulk of his torso and the sharp angles of his chin until she was again looking into the black ovoid eyes. When she spoke she had to fight to keep her voice steady against the emotions surging up inside.

"Kort . . . we're not the same . . . are we?"

"No," the robot replied quietly.

She looked again at the precisely fitted parts that



gave mobility to his arms and shoulders, and at the ingenious system of sliding joints that formed his neck. He was *made*, just as everything else in Merkon was *made* . . . just as Merkon itself was *made*. Everything except . . .

"You're just a doll, like Rassie," she choked. "A doll that the machines made. The machines *made* you, just like they made everything else." She shook her head and gazed at him imploringly. Kort felt sudden concern as his sensors reported thermal patterns across her face that correlated with accelerating blood-flow, and a rapid rise in moisture level in her eyes. Alarm messages were already streaming into his mind from the network.

*"She is registering distress. It is too early for this, Kort. Her mind will overload. Stop this now."*

"We have gone too far to stop," Kort returned. "If I leave her as she is, the uncertainty will only increase her distress. Once she knows all, it will pass."

*"Will she still be the same?"*

*"The same, and better."*

A pause.

*"Agreed."*

With the realization that had hit her so suddenly after twelve years, Taya was too shocked for the tears to come. It took a long time for her to find any voice at all. At last she managed in a faltering whisper,

"I'm the only thing in the whole of Merkon that isn't made. Everything else is the same except me . . ." She paused to moisten her lips. "Kort . . . why am I different? Where . . . where did I come from . . .?"

"For all these years you believed that you and I were the same," Kort said. "Now you have accepted

the truth. That's good. You have to learn to accept the truth as it is before you can hope to learn anything new." The shock was beginning to wear off and her shoulders were trembling beneath her dress. A single tear broke loose and made a wet line down her cheek. Kort lifted a corner of her cloak and used it to wipe the mark away. "Before I can tell you any more you'll have to try and look a bit happier than that," he told her. "Do you think I've changed in some way just because you know something now that you didn't know a few minutes ago?"

"No," she said. She didn't sound convinced.

"I'll make a funny shape when we get home, and call it pretty," Kort offered. Taya tried to force a grin but it only flickered and wouldn't stay put.

"You don't believe me," he accused her, feigning an injured tone of voice.

"I do." She mumbled the words and directed them down at her chest. Kort stepped back and turned round to face away from her. Then he bent double, planted his hands on the floor and straightened his legs above his head until he was looking at her from between his arms.

"Look," he called. "I'm the upside-down man. I live in the upside-down room. It's got upside-down chairs and you can talk to upside-down machines on upside-down screens with upside-down pictures and upside-down buttons." He started making running motions in the air with his legs. Taya raised her head and looked at him sheepishly. The corners of her mouth began twitching of their own accord.

"There isn't an upside-down room," she reproached him.

"Yes there is, if we *imagine* one." The upside-down robot began doing push-ups on his arms, causing his body to bounce up and down between the rows of boxes. The smile that was creeping into Taya's face broadened.

"Has it got an upside-down bed in it too?"

"Of course. Everything in it's upside down."

"But that's no good." Taya couldn't suppress a giggle. "I'd fall out of it."

"No you wouldn't. Everything happens upside down too. You'd fall towards the ceiling."

"Oh Kort," she laughed suddenly. "You're still as silly as ever. You really haven't changed, have you."

"That's what I'm trying to tell you."

"And besides, if *everything* happened upside down you wouldn't be able to tell the difference. So how would you know it was the upside-down room anyway?"

Kort swung his legs down again, righted himself and turned back to face her.

"Exactly! If you can't tell a difference, there isn't any difference. Things don't change just because you think of them a different way. I'm still the same as I've always been. Everything else is still the same as it's always been. The only thing that's different now is that you've accepted that what I am isn't the same as you."

"Kort," the incoming signals said. "*You are taking too many risks. There was no data to support the conjecture that assuming an inverted posture would relieve her overload indications. We are unable to evaluate any decision criteria which point to such an action. What reason have you to suppose it would succeed?*"

*"I know her," Kort answered. "Twelve years of living with her cannot be expressed algorithmically. Trust me."*

*"Very well, but you are making us nervous."*

"So when you talk, it's really the machines talking," Taya said after reflecting for a while.

"In a way yes, in a way no," Kort replied. He moved past her, away from the side where the opened box was, folded his arms on top of the box next to her and rested his chin on them. He had discovered long ago that mimicking the postures which she tended to adopt make her feel at ease. "There are many machine-minds in Merkon. One of them is called Kort and only Kort ever controls this body or talks to you through it. So you've only talked to Kort and you still are. But I talk to the other machine-minds too, so in a way you've been talking to the others as well."

"Why don't the others have bodies like yours too?" Taya asked. "If they did, then I'd be able to talk to all of them myself."

"In a way the whole of Merkon and everything inside it is their body," Kort said. "They all share it and use different parts of it at different times, except that only Kort uses this body. The others don't have a body like this because they don't need one. Kort only made this one for a very special reason."

*"To mend things."*

"No . . . To take care of *you* when you were much smaller and couldn't take care of yourself at all."

"Me?" Taya's eyes opened wide with amazement. "You made it just for *me*?"

"And the rooms you live in, and the places that you can go into, and the tunnels for you to go into

new places. That makes you very special."

Taya wondered how she could possibly be so special that all those things could have been done just for her. It made her feel nice to be told she was special. She stretched out her leg and ran her toe playfully along the edge of one of Kort's elbow joints. He tickled the sole of her foot and she pulled it back sharply with a squeal.

"I am being happier now," she reminded him, although Kort never needed reminding about anything. "I still want to know why I'm different." The robot studied her face for a moment longer, then said,

"It all began a long time ago."

"This sounds like a story."

"We could make it a story if you want to."

"Let's. I like stories. What happened a long time ago?"

"Well," Kort began. "A long time ago there was a mind that woke up and found itself in a place called Merkon."

"A machine-mind?"

"Yes."

"But how could it wake up?" Taya protested. "Machines don't have to sleep like I do. You never have to sleep."

"Maybe 'sleep' is the wrong word. 'Aware' might be a better one. A long time ago a mind realized that it was aware."

"Aware of what?"

"Itself."

"You mean it just knew that it was there and that Merkon was there but before that it hadn't known anything," Taya said. Kort nodded.

"It was like you. It just knew it was there but it

didn't know where it had come from." Taya screwed her face into a puzzled frown and studied her toes while she wriggled them.

"How was that?" she asked. "I can't remember where I came from because I forget things, and when I was a lot smaller I forgot even more things than I do now. Now I'm big enough to be able to think about it, it's too late because it was all so long ago. But how could the machine-mind forget? The machines never forget anything. *You* never forget anything."

"The machines that lived in Merkon very long ago . . . even before the time the story began . . . weren't very clever," Kort replied. "But they could make cleverer machines which could make still cleverer machines until eventually there were machines that were clever enough to realize that they were there and to think of asking how they got there."

"Those were the ones that became aware."

"Yes. They were clever enough to ask the question but they couldn't know the answer because the earlier machines had never thought about it and hadn't put any answers into the information that they passed on to the machines they built. So all the mind knew was that it was there. How it had got there it didn't know because it had happened before it became aware of anything at all."

"It was like me, wasn't it," Taya said thoughtfully. "I couldn't have been aware either. If I had been, I'm sure I'd have remembered it."

"That's right. It asked the same question that you did and for the same reasons."

"Did it find out?"

"That comes at the end of the story. If we're

making it a story we have to tell it in the right order."

"All right. What did the mind do?"

"It thought and thought and thought for a long time, and the more it thought the more puzzled it became. It knew it was there and that it could think, which is another way of saying that it was intelligent. And it knew that what it called its intelligence was the result of the machines that it existed in being so complicated. But it knew that a machine wasn't something that could just happen by itself; it was something that had to be very carefully made. The only thing that could possibly have made a machine was something that could think . . . in other words, something that was already intelligent." Kort waited for a second until Taya nodded to show that she had followed him so far. "So there couldn't have been a mind there to think until there were already machines that the mind could exist in. But there couldn't have been a machine in the first place until there was a mind that could think how to make it."

"But that's impossible!" Taya exclaimed. "It doesn't make sense. It says that they both had to be there first. How could they both be there first?"

"That's what the mind thought too and that's why it was puzzled," Kort replied.

"Maybe there was another mind and it made the machines. The machine-mind could have come later."

"The mind thought of that too but it really didn't answer the question. You see, it could look out across the whole universe through Merkon's eyes and there just wasn't anything anywhere that could possibly become complicated enough to be



intelligent. The only things that existed anywhere that were capable of thinking were machines. A non-machine form of intelligence was impossible. So, if some other mind had built the machines, that mind would have had to exist in a machine itself, so it still didn't answer the question of what had built *that* machine."

"It was asking the same question that I asked at home before we came here," Taya said after a moment's reflection. "Something must have made the *first* machine."

"I know," Kort agreed. "That was why I brought you here." The maintenance pod closed up the box behind where Taya was sitting and scurried back up its rails into the ceiling. Taya was too absorbed to notice and Kort continued,

"While the mind was doing all this thinking it



was still building cleverer machines and connecting them into itself and becoming more complicated. Eventually it got so complicated that it started splitting up into lots of different minds that all lived together in the same machines."

"Did they have names like 'Taya' and 'Kort'?"

"We could give them names," Kort said "Everybody in a story ought to have a name I suppose. One of the first was called 'Mystic'. Mystic said that the riddle of where the first machine had come from was a mystery, which meant that nobody could ever know the answer. There were some things that could never be understood because they were controlled by forces that were invisible, and that was why they had never been seen through any of Merkon's eyes anywhere in the universe."

"But how could he know that?" Taya objected. "If nobody could ever know, how did *he* know? I think he just made it up to save himself the trouble of having to find out."

"That was exactly what one of the other minds said," Kort told her. "The second mind was called 'Scientist'. Scientist said that you should only try to say something about things that you could see. If you started making up things about forces that nobody could see, then you could believe anything you wanted to but you'd never have any way of knowing if what you chose to believe was true or not. If you didn't know whether or not something was true, it was a waste of time believing in it. Just believing in something wouldn't make it true if it wasn't. Scientist claimed that everything could be answered by things that could be seen if you looked hard enough for them, so he spent lots of time

looking out through Merkon's eyes to see if he could find anything that could have become complicated enough to think, and therefore to have made the first machine."

"Did he find anything?" Taya asked. Kort shook his head.

"No. All he could see wherever he looked were things like clouds of dust, balls of hot gas and streams of particles twisting round in magnetic fields. Scientist was very good at sums and he worked out lots of laws that described how the things he saw behaved, but there was nothing in his laws that could have made atoms and molecules organize themselves together in the ways they'd have to have been organized to make a machine."

"You mean there was nothing in the universe that *made* things."

"Right. Mystic said that proved that there had to be a universe that Scientist's eyes couldn't see and to which the laws didn't apply. The mind that had made the first machine had to exist somewhere because the machines were there; at the same time it couldn't exist in Scientist's universe because Scientist's own laws couldn't explain it. Therefore it existed in another universe."

"But the machines still had to be *made*," Taya insisted. "It still doesn't answer the question. Wherever the other mind existed, it would still have had to have had machines to make the first machine with."

"Mystic said it was so intelligent that it didn't need machines to make things with," Kort said. "It could make things out of nothing whenever it wanted, just by wanting to. So it could make machines out of nothing just by wanting to. Mystic

said it had to be called 'Supermind' because it was so intelligent."

"So could it think without having to be a machine?"

"Mystic said it could."

"But then why did it make a first machine?" Taya asked, frowning. "It didn't need one."

"Mystic said it was so intelligent that nobody else could ever understand why it wanted to do things."

"I still don't see how Mystic *knew* it was there," Taya said. "Not if nobody could see it. Didn't any of the other minds ask him how he knew?"

"One did," Kort told her. "His name was 'Sceptic'. Sceptic never believed anything anyone said unless they could prove it. He was very logical and very fussy and if anybody wanted to convince him of something they had to get their thinking exactly right. He was very good for testing ideas on; if somebody thought of something and Sceptic couldn't find anything wrong with it, then it was probably all right. Scientist was always worrying about his laws and asking Sceptic what he thought of them. Sceptic often found mistakes but Scientist was always ready to go away and change them and in the end his laws were able to describe everything in the universe in a way that Sceptic couldn't find anything wrong with."

"Except he still couldn't explain where the first machine had come from," Taya reminded him.

"Sceptic knew that. He said he'd believe that Scientist's laws could explain that when Scientist proved it. They could talk to each other because Sceptic always wanted proof of everything and Scientist was good at proving things. Mystic and Sceptic never talked very much because Sceptic never

believed anything Mystic said."

Taya pushed herself to the edge of the box and stretched her legs out.

"Can I put my shoes on and get down? I'm getting tired of sitting up here." Kort put her shoes on her feet and lifted her to the floor, then retrieved her cloak from where she had been sitting.

"We can leave now," he said. "There is more for you to see farther on. Walk if you want." They began moving towards a door at the end of the room opposite to that at which they had entered.

"Who did the other minds believe, Scientist or Mystic?" Taya asked.

"Some believed Mystic because Scientist didn't seem to be getting any nearer answering the question despite all his laws," Kort replied. "Others thought that Scientist would eventually discover better laws that would give the answer. One of them was called 'Thinker'. He wasn't busy proving things all the time like Scientist was so he had plenty of time to think about them instead. He thought it was right to assume that the first machine had been built by a mind that couldn't have existed in a machine, because that was logical. But he didn't think Mystic was necessarily right to go inventing Supermind just because Mystic couldn't think of anything else; on the other hand Mystic could be right. He thought that Scientist was being more logical in looking for the answer in the universe that could be seen; just because it hadn't been found there yet, that didn't mean that it couldn't exist there."

"That sounds as if Thinker was saying that either of them might be right or wrong," Taya commented.

"Pretty much."

"I could have said that. It doesn't get anybody any nearer."

"That was the way they worked," Kort said. "Thinker thought of things that might be true, Scientist tried to prove whether or not they were and Sceptic decided whether or not Scientist had proved anything."

"What about Mystic?"

"He only talked about the things Scientist hadn't proved yet. All Thinker could say about him was that maybe he was right and maybe he wasn't."

They had left the room where the boxes were and now found themselves standing in an enclosed space, looking in through a window at a room full of bright colored lights and strange glass shapes surrounded by machines and more boxes. Kort told Taya that this was one of the places where Scientist still carried out tests to try and prove whether or not the things Thinker thought about were true. Then he resumed his story.

"But Scientist could never find anything that could be as complicated as a machine without being a machine, so more and more of the minds began thinking that perhaps Mystic was right. They asked Mystic why Supermind had created the machines and Mystic told them that they had all been put in Merkon as a quality test to see if they were good enough to do more important things somewhere else later. So they all started working as efficiently as they could in case Supermind was going to scrap all the bad ones. Some of them tried to speak to Supermind to find out what Supermind really wanted but they never got any answers. Well . . . some of them said they did but Sceptic

wouldn't believe them. Scientist said they were just thinking they could hear what they wanted to hear."

"Mystic doesn't sound very logical to me," Taya remarked as they moved on into another glass tunnel. Ahead of them she could see bright lights of all colors illuminating the inside of the tunnel from every side.

"That was what Thinker and Scientist said," Kort told her. "Mystic said that Scientist never proved anything that was really important, and that Thinker never said anything definite about anything at all. That was why some of the other minds listened to Mystic: at least he said something definite.

"Anyhow, with all this thinking going on and the trying to do better all the time in case what Mystic said about Supermind scrapping the bad ones was right, a strange thing had happened. The machines had changed and become very different from the ones that had first started asking the question."

"You mean the ones who woke up?"

"Yes. All the circuits and parts that didn't work as well as others had been replaced until even Merkon itself was different from what it had first been. And in the process the machines had become even more intelligent. Another mind, called 'Evolutionist', appeared and he suggested that perhaps the non-machine intelligence that everybody had been looking for might have begun in the same kind of way. Evolutionist thought that the reason Scientist had never been able to find anything else that could become intelligent was that Scientist had been looking for the wrong thing. Scientist had been looking for ways in which things

like clouds of dust and gas might come together and *straight away* be intelligent enough to make a machine. Maybe, Evolutionist said, the thing to look for was some kind of process that worked in the same kind of way as the one that had been making the machines grow more intelligent—a process in which something that was very simple to begin with was *slowly* changed into something better. It wouldn't have to be intelligent to begin with but if it improved itself and improved itself long enough, then maybe it could eventually have become intelligent and made the first machine."

"What did the other minds think of that?" Taya asked.

"Thinker thought that maybe it could be true. Sceptic said he'd believe it when somebody could prove it so Scientist started looking for an example of anything that could 'evolve' apart from machines."

"Is that a new word that means improve and improve?"

"Yes. I've just added it to the language."

"How are going to spell it?"

"Why don't we worry about that when it's learning time?"

The tunnel looked out on either side into strange rooms all packed with bewildering machines of gleaming metal, glass and plastic, and all covered in wires. There were many lights, pulsating glows of different colors and sometimes brilliant jagged flashes. Some of the machines were moving intermittently and everywhere she could see the same dull gray boxes that contained electronics. Kort told her that they were in the part of Merkon where Scientist did most of his work.

"Did he find anything else that could evolve?" she asked.

"Eventually he did. You know what 'molecules' are." Taya nodded. "He discovered that some kinds of molecule could grow in solutions containing simpler molecules. The simpler ones joined on to the special ones to form bigger ones. And sometimes a 'better' bigger one would eat up the other bigger ones until there were only better ones left. And then it could happen again to produce a 'better' better one."

Taya looked up at the robot dubiously.

"I don't see how a *molecule* could be intelligent," she said. "I mean . . . something that small couldn't *do* anything, could it. It couldn't have made the first machine."

"Scientist never said it was intelligent," Kort replied. "All he said was that it was something that could evolve and it wasn't a machine, which was all that Evolutionist had asked him to look for. Evolutionist was delighted and claimed that the first machine must have been built by a huge molecule that had evolved so far that it had become intelligent.

"But then Sceptic pointed out that an evolving molecule that had been very carefully made *inside* Merkon was one thing, but what went on outside was another. How could Evolutionist say that a molecule could have built the first machine which made other machines which made Merkon, when Merkon had to be there to make the molecule in to begin with?"

"He was saying it hadn't proved anything," Taya observed. The molecules that Scientist had made inside Merkon didn't prove anything about what



happened outside, before there was any Merkon."

"Exactly. So Scientist started doing lots of sums and examining all his laws to see if there was any way that evolving molecules could have begun on their own outside Merkon. And he found a way in which they could have."

"How?"

"When enough dust and gas falls together outside, it can get hot enough to turn into a star, right?"

"Because of gravity."

"Quite. Well, Scientist's sums told him that it could also fall into smaller things than stars that wouldn't get so hot, and the same kinds of molecules as he had made would be able to come together by themselves and remain intact on those smaller cooler things."

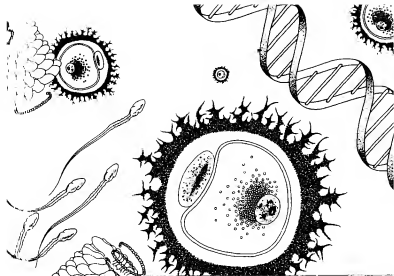
"How could they just come together if it took Scientist and all his machines to make them in Merkon?" Taya objected.

"If there were billions and billions of molecules to start with and if they had millions and millions of years to react with each other, Scientist's sums said that evolving ones would appear eventually," Kort answered.

"But how could he know things like that from just doing sums?" she asked incredulously. She couldn't even imagine millions and millions of years.

"He knew how to do very complicated sums that told him things like that . . . much more complicated than the ones you've learned so far," Kort explained. Taya pulled a face. She didn't dare ask if she would have to learn how to do sums like that too one day.

"So had Scientist proved it?" she asked instead.



"He thought he had but when he told Sceptic what the sums said, Sceptic told him it wasn't good enough. Sceptic said that all they showed was that the cold places that weren't stars *could* exist, and that big molecules that could never exist in a star *might* form on them; the sums didn't *prove* that such places *did* exist, or that such molecules *had* formed on them.

"Mystic said that the whole idea of molecules getting bigger and bigger until they became intelligent was silly anyway. He said all they would turn into would be bigger molecules, not intelligent ones. There were stars outside Merkon that grew bigger and bigger but they just turned into big stars, not intelligent stars.

"Thinker and Evolutionist talked about the problem and came up with a new idea. They pointed out what made machines intelligent was their

very complicated *structure* . . . the way in which they were put together. The thing that enabled them to be made like that was the *information* stored inside the machines that built them. And that information was passed on from one machine to the next. Sometimes parts of it were changed in order to make the newer machine do a new job, or to do an old one better. So really it wasn't the machines that were evolving at all; it was the information they passed on and improved that was *really* evolving. The machines only seemed to be-cause they were being made from information that was getting better all the time."

"I can see that," Taya agreed. "At least, I can with the machines. I'm not sure what it's got to do with molecules though."

"That was the new idea," Kort said. "The way a molecule is put together can also store information. If the information stored in a machine could cause machine pieces to be assembled in just the right way to make an intelligent electronic system, then maybe the information stored in a molecule could cause chemicals to come together in just the right way to make an intelligent chemical system. The different was that the molecules themselves didn't need to be intelligent in the way that had been talked about before. All the molecules had to do now was cause a sufficiently complicated chemical structure to form, and *that* could be what finally became intelligent."

They walked slowly on in silence for a while as Taya digested what Kort had been saying. Eventually she asked in a mildly indignant voice,

"Is today a learning day?"

"Why?"

"Because all we've been talking about are 'learning things'. I thought we only talked about them on learning days."

"Does that mean you don't want to hear the rest of the story today?" Kort asked her.

"Oh no! I want to know what they did after Thinker and Evolutionist had their new idea. What did they do?"

"Mystic said it was just as silly as the other idea. Sceptic said he'd believe it when somebody showed him a molecule that could make chemicals assemble themselves into something intelligent. So Scientist started making lots of enormous molecules and putting them into all kinds of chemicals to see if they would grow into anything." Taya waited expectantly but Kort's tone gave no hint of any ending in sight yet.

"But the possibilities were more than any number of you can think of," he said. "And Scientist had nothing to tell him what kind of molecule to try and make, or what to do with it when he'd made it. He tried for many years but everything failed. He did make a few which produced strange specks of jelly and things without any shape that grew for a little while, but they soon stopped and broke down into just chemicals again. Not one of them ever looked remotely like being intelligent, never mind being able to make a machine.

"Scientist didn't know where to go from there. The numbers of possibilities were so enormous that he could never have hoped to try even a tiny fraction of them. And if it would take him so much time to identify the right molecule with his knowledge and intelligence, how could the right one have been selected in the processes that he saw in

all of the universe outside Merkon? What was there out there that would provide an equivalent method of selection?"

"So what did he do?" Taya asked in a worried voice. "Did he give up trying there?"

"He was about to," Kort said. "But Thinker looked at it another way. You see, Evolutionist was certain by this time that an intelligent chemical system had built the first machine but he needed Scientist to help him prove it in a way that would satisfy Sceptic. So Evolutionist had asked Thinker to see if he could think of any other way that Scientist might be able to prove it, without having to try all the possibilities that were greater than any number you can think of. And Thinker thought about it and said this: if Evolutionist was right, then a molecule that could cause an intelligent chemical system to assemble *had* once existed; somehow in the universe it *had* been selected, whether or not Scientist could explain *how* it had been selected. If they could just track down what *that* molecule had been, then they could forget all about the countless other possibilities that it might have been. So they put the idea to Scientist. Scientist said it seemed a good idea but he couldn't imagine where to begin, so he asked Thinker to think about an idea on that too.

"There was only one place that Thinker could think of to look. There was lots of information that had always been copied from older machines into newer machines and which none of them had ever understood. Some of it had been copies from all the way back to the very earliest machines that had existed long before any of the minds could remember having existed at all. It had always been done and nobody had ever questioned why. Well,

Thinker said, assuming that what Evolutionist claimed was correct, those earliest machines would have been much 'nearer to' the chemical intelligence that had made the first machine. Maybe . . . just maybe, for some reason . . . there could have been something included in all that meaningless data which might give Scientist a clue."

They were approaching the end of the glass tunnel and Taya could now see that it ended at a large shiny white door. She glanced curiously up at Kort but the robot carried on walking slowly and continued with what he was saying.

"So Scientist forgot everything else for a long time and studied the information that had been handed on from before any of the minds could remember, and tried to understand it. And eventually, after many years of trying, he found what he was sure was the secret that he had been searching for. In the oldest information of all he discovered groups of millions and millions of numbers. If he read those numbers in a particular way, he obtained results which looked just like instructions on how to build a few very precise arrangements of gigantic molecules. He worked out all the numbers, made the gigantic molecules and assembled them together in exactly the way that the instructions told him to. Then he began supplying chemicals to them to see if the chemicals would grow into anything like the kind of thing that Evolutionist and Thinker had said they would."

They stopped outside the white door. Taya stared up at Kort with suspense written across her face. The robot gazed down in silence for a few seconds as if inviting her to complete the obvious

for herself.

"What happened?" she asked with bated breath. "Did they grow into something?" Kort shook his head slowly.

"Not at first. At first there were many things that Scientist still did not know. Many of them grew into strange forms that neither Scientist nor anyone else in Merkon had ever seen before, but they soon stopped. Scientist didn't know what chemicals he should give them or how the chemicals should be given." The robot's voice had slowed to an ominous rumble. The black ovoid eyes seemed to take on an inner light of their own as they bore down on the tiny upturned face, now suddenly deathly pale. "He had to learn that they would only grow when the temperature was warm . . . that they had to be always bathed in air . . . air that had to be slightly moist . . ." Taya's eyes had widened until they had become almost full circles. "We had to learn how to make the special food that they needed," Kort went on. "To provide them with light that was just right for their delicate liquid eyes, to keep them covered to protect their fragile skin . . ." Taya's mouth dropped open but no sound came from it. That was the first time that Kort had used the word 'we'. "Yes, Taya. There were many things we had to learn."

Taya could only stand rooted to the spot as at last the truth burst into her mind like light flooding a darkened room. She stood staring up at the seven-foot colossus of steel, unable to speak, unable to think, unable even to move.

"We had many failures," Kort told her, his voice falling for an instant. Then it rose again to echo the pride that he was unable to conceal. "But in the end

we succeeded! We produced a tiny speck of jelly that grew and took shape until it could move of its own accord. We nurtured it and tended it while its form changed, and slowly it transformed into something the like of which we had never glimpsed even in the most remote corners of the cosmos!" He tried to make his voice triumphant and jubilant but even as he spoke he could see Taya beginning to tremble uncontrollably. At the same time alarm signals poured into his circuits from all over Merkon. He stooped down and lifted her level with his eyes.

"Don't you see what this means, Taya? Long, long ago, before there any machines anywhere, there was another kind of life . . . *They* made the place that has become Merkon. *They* built the machines that the machines of Merkon evolved from. They were incredible scientists, Taya. They understood the things which we have been striving for so long to learn . . . They built into their machines the secret that enabled them to grow out of simple unstructured matter that drifts between the stars. Without that secret to guide us all our efforts would have been for nothing. Our greatest achievement . . . the culmination of all our work . . . was nothing but a fragment of the wisdom and knowledge with which they began.

"And now, Taya, we know what they were. They were like *you*! You will grow and become again what they were. You asked if you could ever know enough to understand the machines. Of course you can . . . that and far more than that. It was *your* kind that made us what we are . . . from nothing! Without your kind there would have been no machines. You will teach *us*! You will know more than



all the minds of Merkon together could think of to ask. You will bring to Merkon the wisdom and the knowledge that once existed in another world, in another time."

Taya was too overcome with shock to react. The ovoid eyes peered into her face appealingly, searching for a sign that she shared even a fraction of the joy that he felt. But his sensitive fingers detected only the shaking of her body and his eyes saw that her skin had turned cold. When at last she could speak, her voice was weak and choking.

"There were once other Tayas . . . like me?"

"Yes . . . just like you."

"What . . ." She had to stop to swallow the lump that was forming in the back of her throat. "What . . . happened to them, Kort? Where did they . . . go?"

An unfamiliar feeling surged through Kort's mind. For once, he realized, he had misjudged. His voice fell.

"We have no way of telling. It was very long ago. Before Merkon was changed there were places that were built to contain air. The earlier machines could see no purpose in them and altered them. Presumably your kind of life once inhabited whatever Merkon was built to be. We have no way of telling where they went or what became of them." He could see tears flooding into her eyes now. Gently, in the way that he knew she found comforting, he moved her onto his arm.

"How long ago was it?" she whispered.

"Many hundreds of years," he said. "At least . . ."

"That long . . .? Other Tayas lived here that long ago?" There was a hollowness and an emptiness in her voice that Kort had never heard before. She

clutched at his neck and the surface sensors in his skin detected warm, salty water rolling down across the joints. Her voice choked in his ear between sobs.

"There isn't anybody else anywhere like me . . . I don't belong in this world, do I? Kort . . . I don't want to be in this world any more . . . I want to be in my world . . . in the world where there were other Tayas like me . . . Why did you have to make me be in this world?"

"That world doesn't exist any more," he replied quietly. "Of course you belong in this one. It's as much yours as it is ours. And we're changing it so that it will be even more yours."

"But I'll always be . . . *alone* now. I've never felt alone before, but I do now. I'll always feel alone . . . for years and years and . . . years." She pressed her face into the side of the robot's head and wept freely. "Oh Kort, how long will it go on? Will I always be here now . . . ? What will happen to me, Kort?"

Kort waited in silence for a while, stroking her head with a finger of his free hand, but the arms around his head didn't slacken and the tears wouldn't stop.

"You won't be alone," he murmured at last. "I'll always be here. And you haven't let me finish the story yet."

"I don't want you to tell me any more," she sobbed. "It's a horrible story. I wish you'd never told me any of it." Kort's arm tightened reassuringly.

"Then I'll have to show you the rest of it," he said.

Taya felt him start to move forwards. A few seconds later she became aware of a warm yellow glow



surrounding them. She raised her head a fraction and saw that the white door had opened and they were entering. Kort stopped a few paces inside and she could sense him waiting. She raised her head a little higher and looked . . .

And looked . . .

And suddenly gasped aloud with sheer wonder.

All her tears and fretting had been swept into forgetfulness in those few brief seconds. Kort lifted her from his arm, turned her round to face the room and stooped to set her down on her feet. For a while she just stood staring and then, very slowly as if in a dream, she began moving forwards on into the room.

They were standing in neat rows about five feet apart . . . forty or so, or more of them. Each was like a bed, smaller than Taya's and covered by a

rounded glass cover that enclosed it from end to end. There were tubes and cables connecting the glass boxes to banks of machines that lined one of the walls.

And through the glass covers she could see . . .

She had no word for lots of little people who looked like Taya. There had only ever been one Taya.

She stopped and turned to gaze back at Kort but the robot made no move. She turned back again and, after gazing for a long time, walked slowly towards the box that was standing closest to her. She approached it cautiously, almost reverently, as if the slightest sound or sudden movement might cause the peaceful sleeping figure inside it to vanish as her dreams did when she woke up in her bed. It had eyes and a nose and a pink mouth . . . and it was all 'bendy' everywhere, just like her. It wasn't as big as she was, in fact it was a lot smaller . . . but it was the *same*.

She moved slowly round the box to peer in from the other side. It wasn't exactly the same, she realized. It had dark hair, almost black, and a nose that wasn't the same shape as hers. She turned to look in the box behind and saw that the Taya in that one had brown hair and faint brown patches on its face which she didn't have. And its body was curiously different. She looked around, at the box behind her and the one across from her in the next row. They were all different . . . the *same* as her, but all different.

Kort had by now moved into the room and was standing beside her. She looked up at him speechlessly, unable to form any question because her mouth just hung open and wouldn't close.

"Scientist had no way of knowing how long he would be able to keep his tiny chemical thing growing," Kort resumed. "If it stopped growing in the same way that all the others had, then he would have had to start all over again. So, when he had managed to keep one growing properly for two years, he chose forty-nine more sets of different numbers and made forty-nine more groups of giant molecules. Then he started them all growing in the same way that he'd already managed to make the first one grow. So now he had fifty, all growing properly, but one of them was two years older than the rest."

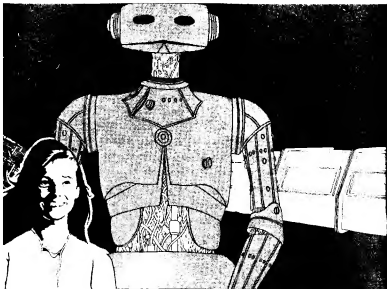
Taya was listening in raptures but she was still unable to keep her eyes off the figures in the boxes. They were all about the same size—bigger than Rassie but much smaller than Taya. Their chests were moving the way hers did when she lay on her bed thinking, not as much as hers did and much more quickly . . . but they were moving. Kort's chest never moved like that because he didn't need air. They were really like her. It was more wonderful that anything she had ever known. It had to be a dream. She didn't want to wake up from it. Some of them were darker than she was, a sort of brown instead of pink, and there were a few that were nearly black. She wondered why there weren't any blue ones or green ones or bright red ones.

"By that time all the minds were saying how clever Scientist was," Kort went on. "But Sceptic pointed out to them that nothing that Scientist had done so far *proved* anything about chemical *intelligence*. All he'd proved was that a set of molecules could make a chemical structure that was capable of growing and moving; he hadn't proved that it

could build a machine. And when the minds thought about it they were forced to agree that Sceptic had a point. You see, even the one that was two years older had never actually done anything that could be called intelligent. All it had done was kick its legs and wriggle about and eat the food that the machines gave it. So they stopped saying how clever Scientist was and settled down to watch and wait for it to do something intelligent."

While Kort was talking, Taya was moving a few steps ahead of him, stopping to gaze through every one of the glass covers to marvel at how delicately a nose was formed here or to stare at a miniature hand there or a brown foot that was pink underneath there. This one had hardly any eyebrows at all while another had thick black ones; this one had hair that was almost red and another had tiny ears not much bigger than Rassie's.

Scientist must have been very clever to make these, she thought to herself, never mind what the other minds said. And then something that Kort had said earlier suddenly came back to her. Scientist hadn't done it all by himself; he'd never have done it at all if he hadn't discovered the secret. And then all at once a new kind of feeling swept through her, a nice feeling . . . the kind of feeling that she had when Kort gave her a difficult sum to do and she got it right first time, except this was much stronger. It was *her* kind, Kort had said — others like her who had lived long ago — who had given Scientist the secret. Before that even Scientist, who could do sums that were bigger than she could even imagine, hadn't known even where to begin. Did that mean that when she grew bigger she would be able to discover secrets that even Scientist couldn't



uncover even with all the machines that they had passed in the glass tunnel? It sounded impossible but Kort had said that *her* kind, the ones who discovered the secret and left it for Scientist to find, had all grown from tiny specks of jelly just as she had. Suddenly she couldn't wait to grow bigger.

When she had reached the end of the room and looked inside every one of the glass covers, she turned. She was happy now, Kort could see, and the laughter in her eyes was echoed by the currents that flowed into his mind from the entire network of Merkon. But there was something else in her eyes as well now. The expression on her face contained more than just the simple happiness that he saw when she watched the stars or created a picture that she especially liked. There was a light of awareness too, which added somehow to the happiness to produce an effect that was new to him

and which he could never have put into words of their language if Taya had asked him to. It was as if in the space of the last few minutes she had suddenly become older and changed more than she had done in all of twelve years. But his story had not ended yet.

"The minds waited for almost another year but no sign of intelligence appeared. Then Mystic began telling them it was because Supermind was angry at the machines for trying to create intelligence. Only Supermind was allowed to create intelligence out of nothing and as a warning it had made Scientist's experiments go wrong. If they didn't take any notice and continued trying to do something that machines were never meant to do, Supermind would scrap every one of them and the whole of Merkon as well. This worried the minds and they began talking among themselves to decide whether or not they should allow Scientist to keep his creations."

There was nothing else to see at the far end of the room. Taya clasped Kort's hand and they began walking slowly side-by-side back between the rows of boxes.

"At about this time a new mind formed out of parts of other minds who had been there for a long time. Most of the new mind came from parts of Scientist, Evolutionist and Thinker. Its name was 'Kort'." Taya stopped and looked up in surprise. Kort paused for a moment, then went on, "Kort had spent a lot of time studying the strange chemical things, watching how they grew and learning about them. He had become very fond of them and didn't want Mystic to take them away. He suggested that perhaps the reason why the machines couldn't see



any intelligence in them was that the machines were looking for the wrong things. They were making the mistake of thinking that the only kind of intelligence that could exist was the kind that they had, because that was the only kind they had ever known. A machine was complete as soon as it was built and it was fully working the moment it was switched on. But it could be different with chemical intelligence, Kort argued. Maybe their intelligence needed time to grow, just as their bodies needed time to grow."

At last Taya felt able to speak again, although her voice still didn't sound quite right when she tried.

"What happened in the end? Did they believe Kort or Mystic?"

"They didn't know who to believe. Some said that the only way to find out if Evolutionist was right or not was to allow the chemical things to carry on growing and see what happened, but others were afraid of that in case Mystic was right and they would all ended up getting scrapped. In the end Kort suggested carrying on with the experiment but with one chemical thing only instead of fifty of them. Then if Mystic was right and Supermind got angry, it would only have reason to get a little bit angry instead of very angry. His idea was to put the forty-nine younger creations to sleep in a special kind of way that could be made to last as long as they wanted, and just let the one that was two years older carry on growing a bit more to see what happened. Kort also said that he would be the only mind that would have anything to do with the creation that would be allowed to carry on growing. Then if Supermind still wanted to scrap anybody it would only scrap Kort and wouldn't have any

reason to scrap the others. That made the other minds feel better about the whole matter and they agreed to let Kort go ahead."

"And that's what they did, isn't it?" Taya said, smiling. Kort nodded.

"Yes. The forty-nine were put to sleep and Kort took charge of the one that was left. One thing he had learned was that the tiny chemical things needed lots of looking after and he had been thinking of making a special machine just for looking after them. That made him wonder what had looked after them long ago, before there had been any machines to do it. He asked Thinker what he thought and the only thing that Thinker could think of was that the small chemical things must have been looked after by the ones that had already grown bigger. Thinker also thought that the bigger ones would be roughly the same shape as the small ones and that maybe that would be a good shape for anything to have if it was supposed to do the same job. So that was the shape that Kort chose for his looking-after machine."

"That was clever," Taya said admiringly. "I don't think I'd have thought of things as clever as Thinker did. So that was when you made your body, wasn't it?"

"Yes."

"I always thought it was that shape for mending things."

"I found out later that it's a very useful body," Kort told her. "These hands aren't very good for much by themselves but I can make them do nearly anything with just a few simple tools. I found that sometimes there were things that they could do faster and more easily than the machines could."

"Can it do other things that the machines can't do?"

"One very important thing. If something is going to become intelligent, it has to be able to learn things. It can only learn things if somebody can talk to it to teach it. Scientist had known for a long time that the chemical things couldn't talk because they couldn't hear radio waves. But he'd found out that they could make pressure waves in the air that they had to be in all the time; they were always making pressure waves. So Kort decided to build his looking-after machine in such a way that it could make pressure waves too. Then maybe he could find a way of using them to talk with instead of radio waves. The chemical thing grew and grew, and as it grew Kort taught it to talk."

"You haven't told me its name yet," Taya said. "It's got to have a name. You said that everybody in a story should have a name."

"He called her 'Taya', of course," Kort told her. Taya laughed.

"I know he did. I just wanted to hear you say it."

"Taya grew bigger and Kort began trying to teach her things. All the minds in Merkon waited to see what would happen. But as time went by they became more and more disappointed." Taya's mouth opened in sudden dismay but Kort went on, "She just wasn't any good at any of the things that they expected her to be able to do . . . things that any new machine could do straight away. She talked so slowly that Kort could have conversations with hundreds of other minds while he was waiting for the next word to come out of her mouth. She was hopeless at even the simplest of sums and she forgot things almost as fast as he was trying to teach

her new things. Her ears were so weak that she could only hear him when he was standing almost next to her and her eyes could never see more than a few of the nearest stars, and then only a small part of what they really looked like. Mystic asked how anybody could possibly call her intelligent and said it was a final warning from Supermind for her to be scrapped."

"Me?" Taya clapped her hand to her mouth in wide-eyed horror. "Mystic wanted to scrap *me*?"

"At one time, yes," Kort told her. "But Kort argued with the rest of the minds and demanded that they keep to the agreement that they had made. But while all the arguing was still going on, a strange thing started to happen: Taya began to change." Kort paused and gazed down at the face staring apprehensively up at him from no higher than his waist.

"The machines knew that they could see lots of things that she couldn't. But then they realized to their astonishment that *she* could see other things that they couldn't see. She could see things in shapes and colors that made her smile. She thought of questions that all the minds in Merkon had never thought of asking in hundreds of years. She could *imagine* things that weren't there and create her own worlds inside her mind whenever she wanted, and change them whenever she pleased. She could see things that made her laugh and sometimes things that made water flow from her eyes. The machines discovered that they felt good when she laughed and it made them want to laugh too, and they felt bad when she saw things that made her cry so they tried to find ways of making those things go away.

"Soon all the minds in Merkon found out what Kort had already found: they liked their world better now that it had Taya in it. They didn't want it to go back to being the way it had been before Scientist created her. The thought of that seemed empty and cold, like the emptiness between Merkon and the stars. She was like a tiny star brightening up the inside of Merkon.

"Even Mystic saw her completely differently now. Mystic claimed that the things Taya could see at last proved what even Scientist had been unable to prove: that there was a universe that couldn't be seen with all of Scientist's instruments. Supermind had allowed Scientist to create Taya to prove that Supermind really existed. All the minds believed Mystic and decided that there was a universe that only Taya would ever be able to see, and that she would be able to uncover secrets that they would never have even guessed might exist."

"Did they *all* believe Mystic . . . even Sceptic?" Taya asked incredulously.

"Even Sceptic. That was how the other minds knew that Mystic had to be right."

"And was the Merkon in the story always moving towards a star like this Merkon is?" she added thoughtfully.

"Oh yes. It was just like this Merkon."

"And did it ever get there? What happened when it did?"

"You know, it's strange you should mention that," Kort said. "I've just heard from Rassie. She tells me that Vaxis has just started getting bigger. Scientist says that Merkon will be there in just over ten years from now."

"*Ten years!*" Taya gaped up at him. "That's a long

time. It's even nearly as long as since I started growing and that's longer than I can even remember. I can't wait *ten years* to find out what happens . . .” She broke off as a new thought crossed her mind and then frowned up at Kort suspiciously. “Did Rassie really just tell you that?”

“Why do you ask?”

“She didn’t!” Taya exclaimed. “Rassie doesn’t really talk. You’ve known about it for a long time, haven’t you. You have, haven’t you?”

“Yes,” Kort confessed.

“So why didn’t you tell me before?”

“Because I know how impatient you are, little seer-of-invisible-universes. You think ten years is a long time but it isn’t. There will be lots to learn and lots to do in that time.”

“Anyhow, how did you know that I told Rassie to tell me if Vaxis got any bigger? You weren’t even there. You were away mending something.”

“I know everything,” Kort said.

They had resumed walking and were back at the door through which they had entered. Kort stopped while Taya turned to look back over the rows of glass boxes.

“Is that the end of the story?” she enquired.

“Almost,” Kort replied, guessing her next question.

“But you haven’t told me what happened to the forty-nine others.”

“The minds asked Scientist to wake the forty-nine up again and let them carry on growing from where he had stopped them.”

“So when will he do it?” Taya asked, abandoning the pretence of a story in her eagerness.

“He’s already started to. But they haven’t been

asleep in the same way that you go to sleep. They've been kept very cold for a long time and they can only be warmed up again very slowly and very carefully."

"But how long will it take?"

"Not long. Scientist says about another five days."

"*Five days!* I won't have to wait five days before I can talk to them, will I? I'll never be able to wait *five days*."

"You see how impatient you are," Kort told her. "You'll have to be a lot more patient if you want to talk to them. They won't be able to talk as soon as they wake up."

"They won't?"

"Of course not. They don't know the language yet. They'll have to learn it just as we had to," Kort said. Taya gasped.

"Are you going to have to teach every one of them?"

"Certainly not. You are going to have to help me teach them."

"*Me?*" Taya stared up at him in amazement. "But I can't teach things. I've never taught anything. How will I know how to teach things?"

"That's something else you'll have to learn how to do," Kort replied. "You see, there will be a lot for you to do between now and when Merkon reaches Vaxis."

"But there are all kinds of things they'll need to learn," Taya protested. "Will I have to teach them about Merkon and the machines . . . and how to make clothes and pictures . . . and spell words . . . and do *sums*?"

"I said you'd be busy," Kort nodded. "But it won't be as bad as you think. When they wake up and

start growing again, you will be eight years older than they are. You've learned lots of things in the last eight years that they won't know yet. Then when they are twelve you will be twenty and by then you will have learned more still. Between the two of us we ought to be able to manage."

Taya tried to picture the forms in the boxes walking around and talking and trying to learn all the things that she'd had to learn. There would be so many things that she'd have to remember. Would they come to her with problems the way she went to Kort with hers, and would they keep asking all the same kinds of questions that she did?

"I'm going to be very special, aren't I?" she mused, half to herself.

"Very," Kort replied. "To them and to us."

"Have we got a word for somebody that's special?" she asked.

"No we haven't," he replied. "We've never needed one before. Maybe we ought to have one. Then everybody will know that you're special because you're not called the same word as all the others."

"How about 'queen'?" Taya suggested. "That's a nice word. Could a 'queen' be a Taya-person who is eight years older than anybody else and knows more things than they do and has to teach them things?"

"I don't see why not. Would you like to be a queen?"

"Yes. So am I?"

"Not really," Kort answered. "Because there aren't really any others yet. But you will be in five days time."

"But I want to be special *now*," she said wistfully. "I don't want to have to wait *five days* to be special."



Can't we have another word that means somebody who isn't a queen yet but who will be in five days time?"

"Of course we can. Let's say that somebody like that is a . . . 'princess'."

"That's a nice word too," Taya said brightly. "So am I a princess right now?"

"Right now," Kort confirmed. "I've already written it into the dictionary." Taya looked down at herself and after a few seconds raised a disappointed face towards the watching robot.

"I still don't *feel* special," she told him in a thin voice.

"How did you expect to feel?"

"I don't know, but there ought to be *something* different about being a princess. I still feel like a Taya."

"I'll tell you what we'll do," Kort said. "We'll make a rule that says the princess has to look different from anybody else. Then everybody will know who she is, even if they're still very small and aren't very good at remembering things yet."

"How will we do that?" Taya asked eagerly.

Kort took her cloak from his pouch, draped it over her shoulders and fastened the clasp at her throat.

"There," he announced. "Only the princess will be allowed to wear a red cloak. You're wearing it and that says that you're the princess." Taya stepped back and looked happily down at her sides as she spread the cloak wide with her arms. Then she twirled gaily round, causing it to billow out in the air.

"I *feel* like a princess," she laughed. "I'm really really special already, aren't I?"

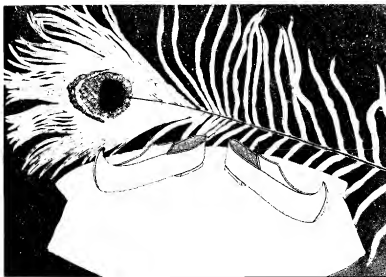
The mighty robot bent low and offered his arm in an unspoken invitation.

"Come, little princess," he said. "We must go home now. Scientist has lots of work to do in here." Taya climbed onto the bend of his elbow and clung to his head as he straightened up and turned for the door.

"Will you make me some shoes that are silver like yours?" she asked. "I think a princess should wear silver shoes too, don't you?"

"A princess should have anything she wants," Kort replied.

The door behind them closed silently to cut off the yellow glow. They began moving back along the glass-walled tunnel that would bring them to where the capsule was waiting to carry them home. ●



#1

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# NEW JOVE! BEGINNINGS

by  
**JE. POURNELLE**  
PH.D.



**It changes  
like dreams.**

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It all changes like dreams. We've got perhaps the shortest delay between my writing this and its publication of any major magazine—and this may all be obsolete by the time you read it. In fact, I hope so.

Set the scene. To get to Cal Tech's Jet Propulsion Laboratory (JPL), you drive out the arroyo where a hundred years ago Tiburcio Vasquez and his gang fled from a Pasadena posse. JPL is there because, eons ago, they actually tested small rockets at the labs, and the City Fathers were concerned lest Cal Tech blow up parts of Pasadena and San Marino; the arroyo was considered expendable.

Of course since that time others have moved in, so that not far from JPL's fenced and guarded boundary they've built one of the most expensive bedroom communities in the world, but what the hell. JPL still rules the arroyo, and like most such institutions boasts a mixed architecture: ultra-modern glass office tower, lower buildings with vaguely Spanish arches and verandas, interspersed with "temporary" clapboard buildings constructed during World War II. The press facility is in the von Karman Center, a one-story somewhat modernistic structure of severely square architecture at the very boundary of the labs, located one supposes so that press types could be accommodated without being admitted to the guarded laboratory areas. There are guards in evidence everywhere, and you're supposed to wear badges at all times.

Inside the von Karman center there's a large room with raised dais for scientists, a wooden platform for TV camera crews, lots of chairs for reporters and guests—and rather spectacularly, an exact full-size replica of Voyager. The walls are lined with magnificent photographs taken by one or another of the JPL-operated spacecraft (there've been a LOT of them); just at the moment, of course, the data from VOYAGER 1 dominates. Everywhere you look you can see Jupiter and his satellites in detail orders of magnitude better than the largest earth-bound telescopes ever could deliver.

The room is reasonably full; not quite as full as it was during the VOYAGER 1 encounter, certainly not packed to the gills the way it was the night VIKING landed on Mars, but many of the regular science press corps are present, as well as a goodly contingent of science fiction writers.



Come now the scientists charged with understanding just what VOYAGER is telling us. Frank Bristow, JPL press relations manager, introduces Larry Soderblom. Dr. Soderblom, US Geological Survey, is deputy team leader of the imaging science experiments. (Imaging science means what you think it does: getting pictures we can look at.)

He opens rather simply. "We used to think we understood planets."

Next time somebody questions the value of spacecraft like VOYAGER, quote that line.

\* \* \*

On August 20, 1977, VOYAGER 2 left Cape Canaveral aboard a Titan-Centaur rocket. Two weeks later, on September 5, VOYAGER 1 was boosted into a somewhat faster trajectory. The VOYAGER orbits are planned with space-age technology—that is, modern computers have given us an ability to send spacecraft on highly sophisticated tours (the Voyagers use Jupiter's enormous gravity to slingshot themselves on out to Saturn), and of course most modern computer circuitry was developed for spacecraft. Incidentally, much of the computer program which guides the Voyagers to Jupiter and onward was written by Dan Alderson (only the Russians can navigate spacecraft without an Alderson program), who is perhaps better known among science fiction readers as the inventor of the Alderson Drive I use in my CoDominium series stories.

VOYAGER 1 arrived at Jupiter in early 1979, with closest approach March 4 and 5. VOYAGER 2 got there in mid-July. Between them they sent back more information on Jupiter and his moons than mankind has been able to accumulate throughout

all history. To quote Dr. Soderblom again, VOYAGER has shown us the Solar System's "oldest, youngest, biggest, brightest, dullest, reddest, most active, and least active planets—and now we can add to that the flattest." Prior to VOYAGER we knew almost nothing about Jupiter's moons other than their sizes and brightnesses.

The flattest planet in the solar system—Jupiter's largest moons are comparable in size to Mercury and it makes sense to refer to them as planets rather than mere moons—is Europa, the third moon out.

Jupiter has either 13 or 14 moons. The largest four are called Galileans because they were discovered by Galileo. Confusingly, they are numbered J-I through IV, but they are the 2nd through 5th out: Galilio wasn't able to see tiny (240 km. diameter) Amalthea, which whizzes around only 180,000 km. from Jupiter's center. Europa is J-II.

Europa is a bit over 3000 km. in diameter, and is *really* flat; any surface feature must be less than 100 meters in depth; the Voyagers saw no surface relief at all. Of course there *are* surface *features*: Europa is criss-crossed by lines resembling dune buggy tracks, some over 1000 km. long and hundreds of km. wide. So there we have this cosmic billiard ball, known to be at least 50% ice, probably covered with a thin shell over an ice mantle. (It sounds a bit like an enormous egg, with cracks from imminent hatching.) Given the absence of relief it's probable most of the surface is a kind of mushy ice.

Then there's Io (J-I), the Galilean closest to Jupiter. According to Larry Soderblom, you could make Europa by starting with Io and adding water. Io is close enough to Jupiter to be involved with the

Jovian magnetic field in what is called a "flux tube", namely the region where magnetic lines of force from Jupiter pass through Io. VOYAGER 1 measured a current of 5 million amperes in that flux tube, which would be fascinating enough, but what makes Io *really* interesting is the volcanoes. Let me set another scene.

During an encounter, the von Karman Center at JPL is a madhouse. All over the center there are TV screens, and every minute or so there's a new picture coming in from Jupiter. Go to the bathroom and the spacecraft has moved another 10,000 miles, and you may have missed something important.

There are two press rooms, both over-crowded. Each room has a dozen or so tables, and on each table are two or three typewriters and telephones supposedly reserved for working press types with deadlines to meet. In addition to those hordes (VOYAGER 1 drew reporters from nearly every major paper in the country) there are reps from magazines with short lead time (such as *Science News*). Add to the mixture a sprinkling of columnists and book writers. Now stir in over two dozen science fictioners thoughtfully invited by JPL Public Relations Director Frank Colella, and the rooms are jammed. Moreover, they *stay* that way. Nobody dares leave because of the nature of the data coming in.

I know that doesn't sound reasonable. Sure, there's a big thrill attached to being there as it happens, but you'd think those of us without short deadlines could with some profit sit back and wait. Unfortunately it doesn't work that way because of the nature of the data. If you don't see those pictures as they come in, the chances are good that

you'll *never* see them again, and I expect that's worth an explanation.

Start with the spacecraft. They have aboard a good slow-scan TV camera which takes a picture of whatever the science team has decided to look at. The picture is recorded aboard the spacecraft—and now what can you do with it? You certainly aren't going to send it across half a billion miles as a picture! Instead, the image is broken up into little bits of data, mere strings of numbers, which are squirted at 115,000 bits/second through a high-gain antenna towards Earth. Incidentally, the Caltech-designed transmitter sending that data uses less than 100 Watts, which means that receiving the picture is a little like seeing a 100 Watt lightbulb blinking on and off at a distance of 500 million miles.

The string of numbers comes through the Deep Space network to JPL, and is recorded on tape. It is of course totally incomprehensible to humans, so the data must be translated by a computer. The computer takes those numbers and generates an image on a TV screen. Scientists and reporters get to look at the picture at exactly the same time.

The image stays up until another one comes in, then the old one vanishes. Now sure, the data string has been recorded, and the image could in theory be generated again—but the two spacecrafts will send back some 40,000 pictures over their lifetimes, and there's nowhere near enough money to make hard copies of all of them. In practice JPL makes black and white photos of those images thought really interesting, color photos of those especially so, and lithographs of the most spectacular; but all together that's a very small percentage of the total.

Back to Io. Until VOYAGER 1, no one had the faintest notion of what Io looked like. It's just too small to see from Earth. So there we were, reporters, scientists, and SF types alike, glued to the screens—and the results were certainly worth it. The first shots of Io showed an enormous heart-shaped feature, quite dark and totally incomprehensible. Later that evening there was a satellite-relay conference that included among others our own Arthur Clarke and *NY Times* Science reporter Walter Sullivan. Sullivan mentioned that Io was named for a young lady who attracted the attentions of Jupiter and who was turned into a heifer in order to hide her from Jove's jealous wife—and that Io! you could see on Io her very hoofprint.

Instantly a conspiracy was born: most of the SF types have agreed that henceforth and forever that large Ionian feature will be known as "Sullivan's Hoofprint" in all our stories. It makes an interesting contest: who has the most influence, the IAU which officially names such features, or we bards?

But we weren't done with the excitement yet. As VOYAGER 1 got closer to Io there came up the most spectacular picture of the lot: a volcano in the act of erupting. It turns out that's a fairly common event on Io, making J-I the most active planet in the solar system—but before that picture came up, no one suspected Io of volcanism at all. Now you understand why those of us fortunate enough to be out at JPL during an encounter hate to leave the screens even long enough to go to the loo.

VOYAGER 2 conducted a "volcano watch" on Io, and found more volcanic activity; so much that Sullivan's Hoofprint is now obscured by a volcanic

plume. The volcanoes inject all kinds of material into the Jovian system; Io's orbit is marked by a torus (doughnut) of ionized gasses running right around Jupiter. Inside Io's orbit there are streams of trapped particles, a thin plasma of oxygen, sulfur, and sodium; some of the trapped particles have been accelerated to 10% of the velocity of light.

While we were waiting for more spacecraft pictures of Io, we had a new treat: Rick Sternbach had brought his paints and did a lovely view of Jupiter as seen from Io, with a volcanic plume in the foreground.

Io is the innermost Galilean moon. Below her is Amalthea, a small dark-red body about 80 miles wide by 100 long, shaped and colored something like a giant kidney bean; and below that is Jupiter's ring. It's not much of a ring, compared to Saturn's, but it's there, and VOYAGER 2 got a really spectacular picture of it. The ring seems to extend right down to Jupiter's cloud tops!

There are two more worlds circling Jupiter. Callisto is battered and cratered like Mars and our Moon, and also like them has large basins; but there's a definite difference. Callisto has water and lots of it. The surface is thought to be dirty ice. Finally we have Jupiter's largest Moon, Ganymede.

To make Ganymede, take Callisto and smash it with a REALLY big object. Voyager 2 found that Ganymede has been hit by something so enormous as to crack the planet like an egg, making rings that go halfway around. The collision could have started the internal events (circulation of interior liquid material) that produced the mysterious grooved terrain that seems unique to Ganymede.

And finally there's Jupiter himself, enormous, a

mod cosmic Christmas-tree ornament painted with an airbrush, glorious, beautiful, and absolutely weird because while Jupiter is by far the largest planet we know of (it masses more than all the other planets and moons and asteroids combined) there may not be any planet down there at all, which, when you come down to it, is pretty silly. I mean, we know of plenty of planets without atmosphere, but an atmosphere without a planet?

Actually, they suspect there's a rather small iron-silicate core about the size of a Galilean moon down at bottom, but given Jupiter's 71,000 km. radius the tiny size of the "planet" is faintly ridiculous. It's also not certain; scientists currently infer the existence of a core because iron and silicates do exist in the cosmos, and there ought to be *some* of each in Jupiter; and if there they would sink down to the center. If the core exists, it would be *hot*: 30,000 degrees Kelvin, or 54,000 F.

Outside the (suspected) core current models put a thick layer of mostly hydrogen, under such pressure that it forms a liquid metal. Of course no one has ever had any metallic hydrogen to play with; it can only exist at pressures of about 3 million atmospheres. We can make up computer models to predict properties of such a substance, but those will only be educated guesses—until we can put a probe down into the Jovian interior.

That won't happen for a while. Although the Galileo spacecraft (to be launched by Shuttle; more later) will send a probe down into Jupiter, it won't get below the atmosphere, and certainly can't get down to the "planet" itself.

But if there's not much planet to Jupiter, there certainly is weather. For example, Jupiter is

banded; by convention we call the light-colored bands "zones" and the dark ones "belts," but they're both merely weather. However, they've persisted for a very long time, hundreds of years that we know of, as gasses warmed by Jupiter's internal heat (Jove gives off more heat than he receives from the Sun; in fact the internal heat source is so much more important than solar heating that the equatorial region is no warmer than the poles) rise and cool, condense in the upper atmosphere, and are deflected by Coriolis forces. It is thought that a similar but much smaller mechanism creates Earth's Trade Winds.

Another weather feature is the famous Red Spot, known for 300 years. It was once thought the Spot was caused by some surface feature far below it, but that's not possible: not only is there no surface to *have* features, but the Spot moves all around through its zone, eventually circling the planet. Current belief is that the Red Spot is a giant (it's larger than Earth!) and rather permanent hurricane.

And so on. I could fill five times the space of this column with gosh-wow stuff learned from VOYAGER. Unfortunately, that's about *all* I could do with it; we've got too much data and too few theories at the moment. Until the planetary scientists have a chance to digest all that information there's no way to make sense of what we know, and no systematic way to present what we've learned. After all, in the past few months we've looked at four small worlds about which we previously knew absolutely nothing beyond their sizes, while getting a close look at a giant world about which we didn't know a great deal more.



So what does it all mean? Sure, there are pretty pictures, and gosh-wow information, but was it worth the cost? Why spend all that money on Jupiter? How can it change your life?

\* \* \*

Query: is it important that we understand Earth?

In one sense that's a ridiculous question. We'd better understand our planet. We live here. At the same time, there are some things we don't need to know. What good does it do to know about stuff that won't happen for thousands of years? As Keynes observed, in the long run we are all dead.

And this is the "Now" generation. We want "it," and we want "it" now; to hell with investment, and devil take our grandchildren. What did they ever do for us?

Yet doesn't Jupiter have something even for the most hedonistic? Surely even the most self-indulgent must get some pleasure from the pretty pictures, and have some idle curiosity about our solar system. And it didn't cost much: the whole VOYAGER program came to about \$340 million, not peanuts but only a little more than a buck for each of us. The entertainment value alone must be worth more than that?

Those concerned with more than infantile gratifications already know it's important to understand Earth; and I don't suppose there are too many readers addicted to science fiction who question the value of knowledge about the solar system in general. After all, Earth is not man's home; the whole system is. True, access is a bit restricted just now, but we can hope that's a tem-

porary condition.

Mr. Heinlein has more than a hope. He's certain. If you ever have doubts about the future of mankind, nothing will buoy up your spirits more than being with him during a major event like the VOYAGER encounter.

"Our race *will* spread out through space," he says. "Unlimited room, unlimited energy, unlimited wealth. This is certain. But I am not certain that the working language of space exploration will be English. I hope so, but if the people of the United States suffer a loss of nerve and fail to follow through it might be Russian, Chinese, German, Japanese, Hindi, or Swahili." As I write this, he's about to go to Washington (in mid-summer yet!) to say that to the Congress. I hope someone's listening . . .

\* \* \*

Thanks to JPL's recent policy of inviting science fiction writers to their spectaculars, the VOYAGER encounters became a kind of gathering of the clan. The Andersons, the Heinleins, the Nivens, George Scithers, Van Vogt, Gordon Dickson, Hal Clement, Fred Pohl, John Carr, the Goldins, Gred Benford, the Williamsons, Rick Sternbach, Ted Sturgeon, Harry Stine, and a host of others came out for one or the other, and since I live out here it seemed like a great occasion to throw a party. Two parties, actually, one after each VOYAGER went by.

There was a slightly different character to each.

After VOYAGER 1 we were all keyed up, excited by our first look at not one, but four new planets, as well as the new information on Jupiter himself.

After VOYAGER 2 there was excitement, but it was a bit wistful as well. Sure, the Voyagers are going on to Saturn, and in November 1980 we'll get new looks at the Saturnian system: six more planets, including Titan, the largest "moon" in our neighborhood; and we'll be surprised indeed if there aren't new surprises. But—we won't see Jupiter close up again until the GALILEO spacecraft arrives there in 1985; and meanwhile, as we partied, SKYLAB was falling.

Moreover, GALILEO isn't all that certain. Oh, it's budgeted, and the chances are good that we'll get it; but given the current attitude in Washington, you know the politicians will kill both GALILEO and Shuttle if they have half a chance. Fortunately that will be hard to do: bureaucratic inertia works in our favor.

GALILEO will be a highly ambitious project. If all goes well, it will fly from Canaveral in 1982, the first interplanetary mission to use Shuttle to get to Earth orbit.

From Earth, GALILEO will head for, not Jupiter, but Mars: by coming close to Mars, the spacecraft picks up free velocity. And by close, they mean *close*: GALILEO will come within 275 miles of the Martian surface before heading on to Jupiter in June-July of 1985 (and I know where *I'll* be then!).

Five months before GALILEO arrives at Jupiter, the spacecraft is scheduled to break into two parts: the Orbiter, and the Probe. The Orbiter will pass into the Jovian system, encountering each of the Galilean planets in turn and using the gravity of each to send it on its way toward another. Those encounters will be close too: a few hundred kilometers, giving us details of features less than a hundred meters in size.

Meanwhile the Probe continues on to enter the Jovian atmosphere itself, deploying parachutes to slow its descent. For about an hour the Probe will send up data on Jupiter's atmosphere, until eventually it sinks so low that its signals can't get out. By then the temperatures and pressures will be so high that the Probe couldn't survive anyway.

Once the Probe has died, Orbiter's main engine will burn to send the spacecraft caroming around among the moons. While there it will collect data on Jupiter's magnetic field and the plasmas that permeate the Jovian system: and *that* information will tell scientists a lot about plasmas and plasma stability in general, allowing better theories on just how plasmas behave.

A good theory of plasma activity is a major requirement for developing practical fusion generators.

Meanwhile, planetary scientists are in a fever pitch of activity. Throughout all of man's history we've had only one planet to study. Theory outstripped data; it's very hard to select among theories about *anything* if you've only one specimen to examine. Now, though, we've had a good look at all the inner planets plus the four Jovian "moons" plus Jupiter himself. There are new data, and from those data we'll get new and better theories of the planets: all of them, including the one we live on.

As Helmholtz observed in the last century, "The most practical thing in the world is a good theory."

The best way to get new theories is to have your old ones shot down by new observations.

We used to think we understood planets. Now, thanks to the spacecraft, we know better. ●

# THREE ALIENS

by Kevin O'Donnell, Jr.



Nothing else can love you  
like a human can...

Illustrated by Steve Fabian



Marjorie Trewellyn Featherstone's resolve broke on 4 June 5249, the day they tested her brain implant. It wasn't large—the size of a thumbnail, perhaps—and it didn't weight more than a lock of hair, but when Capella III's central computer radioed a command that launched her on a series of jumping jacks, she knew she'd had enough. *One-two, one-two*, pulsed the micro-interface; "One-two-one-two," she gasped in rhythm, in step, in time to a music not her own. Vainly did she resist; it bypassed her consciousness to make her body a marionette. Her feet tapped, her square hands slapped, her hair stung her sea-blue eyes. *One-two, one*—And the sequence stopped with her fingers steeped over her head.

"It seems appropriately calibrated," said the installation med, looking up from his data-dotted screen.

She tore the mind-master off her forehead and threw it at the floor. It \*snicked\* as it broke. "No way," she snapped, fighting down nausea.

He was confused. "Did I miss a feedback cycle? I could have sworn—"

She hugged herself, but still was cold. "I won't wear it."

"But—"

"Ever!" Now she shivered with rage as well.

Confusion gone, he sighed. He'd seen this scene a dozen times, at least, and knew his exit cue when it came. "You'll have to speak to the Citizenship Commission." Gesturing to the corner of his white-paneled office, he said, "Use the telscreen, it's got a privacy shield."

"Thanks." She started towards its glowing console.

"You're wrong, you know," he threw after her. Still trembling, she turned. "Why?"

"It's not that bad; you get used to it quickly. And it's a small price to pay."

"Two years?" Her voice, meaning to be scornful, quavered.

"I know, you're only twenty-five, to you it's forever. When you get to be my age, though, into your tenth or twelfth century, you can do two years every hundred holding your breath." He studied the set of her jaw. "I know, it's none of my business, but I shipped with your old man, and—Give it a try."

"Once it's in I can't shut it off."

"True. But you won't want to, either."

"That's what scares me." She met his bark-brown eyes levelly. "That, and the fact that I'd never know if it were on or off." Dropping into the chair before the telscreen, she asked for the Citizenship Commission. The Application Manager came on line almost immediately, green eyes twinkling, black hair bristling, pink skin showing nothing of her three thousand years. "Marjorie," she beamed, "how nice of you to call. Are you being prepped for the implant?"

"No. I'm not going to have it." To the gentle quirk of the manager's eyebrows, she answered, "It's cold and ruthless, like a gag in my mouth, I can't *breathe*! I'm a person, not a peripheral, and I *won't* let any damn computer puppet me around! No matter—"

"Marjorie, you're upset, perhaps you should go home—"

"—and think it over? Hah! I have thought about it,



and I won't submit to it, ever. I won't!"

"Then you'll be denied citizenship, which means you can't own property in the Capella System, or be granted access to our InfoNet, or hold office—"

"Why does the Crazy Rock Coop use this damn system anyway? Why do I have to be a slave to a machine for two years—not just now, but two years every century—to stay a citizen?"

"Marjorie, you know the answer. You studied it in school. Each of us donates 2% of his life to public service—I do, the President does, the members of the High Council do—because it's the only way to prevent stagnation in government."

"That's a crock! I suspected it even when I was a kid, but now, now I've *felt* it, I *know*. The machine stays the same, and it's the machine that gives the orders—or don't you call that stagnation?"

"Of course, child, of course—but the machine exposes you to reality. Call it post-graduate studies. It shuttles you through the system; you'll see how it all fits together, works together—and when your term is finished, you can use your knowledge to change what needs to be changed. And besides—"

She stared at those merry green eyes, wanting to hate them, yet unable to. "What?"

"You're a fiery young woman, eloquent when you wish to be, and I have a feeling that you'll follow your parents, god rest their souls, into politics. Let me ask you: would you want your life determined by a politician who has never had *his* life determined? Forcing everyone into total obedience for two years out of a hundred means—and we have proven this—that everyone has more freedom for the other ninety-eight. Listen, dear, you're emotional today. Why don't you go home—"

"No! I will not relax and change my mind. I will not subordinate my soul to a computer no matter what—"

The smooth face softened into sadness, a sadness mixed with fatalism. Featherstone wasn't the first to refuse, nor would she be the last. "Then you'll have to leave us."

"That's fine by me. I'm on my way." Rising, ordering the connection severed, she slammed in her chair—putting all her 64 kilos behind the shove—and stalked out of the office. She didn't even say goodbye.

The Central Computer Building sat halfway up a hill on the north side of Snow City, the capital of Better'n'ome, the local name for Capella III. Sunlight washed across the vast granite plaza between the building and the slope. Featherstone stood there, her shadow reaching back like a leach ready to be snapped, while she sorted things out in her mind.

*Am I wrong? No. Disillusioned, definitely, but not wrong. All my life they told me about freedom, excited me with promises, turn 25, be an adult, be free; didn't tell me —* Thinking of how her body had danced to the computer's song, she shuddered. *Oh, they said, freedom, got to work for it, have to defend it, get into the system and it will set you free, but they lied. All of 'em, they lied. Thing in your head, they say it runs you for two years, runs you to make the system better, then they turn it off, uh-uh, not for me. No.*

Scorning the esc-shaft, she plunged down the staircase; one flight, two flights, the sky a cloudless blue, the wind blowing the perfume of Snow City's myriad gardens past her; three flights, four flights,

the steps firm and clean beneath her boots, the city sprawled before her like a house-dotted park, its tree-tops tossing their leaves back and forth; five flights, six, and she hopped into the first auto-taxi in line, saying, "The spaceport, and quick."

It could be her last glimpse of her birthplace, her home for the twenty-five years of her life. She ignored it. She closed her eyes, not wanting to recognize the people on the sidewalks. The liars; the unfree. Most of them knew her, if not personally, at least by sight. Births come rarely in a society of immortals, and children stay "news" for a good many decades. Especially when their parents are as popular as hers had been.

An occasional building shot past like a bullet. The wind through the vent ruffled her short brown hair; sunlight glinted off its auburn highlights. She leaned back and blamed air-borne dust for the moisture in her eyes.

"Spaceport," called the auto-taxi as it slowed for the gates.

"Berth 694." When they stopped at her ship, the *Curlicue*, the voice-print faremeter flashed the amount it had deducted from her bank balance. She okayed it instantly, then was out and up the ramp so quickly that she had to wait for Curly to open the lock, meanwhile already saying, "Check yourself out and get clearance, we're leaving." She hated goodbyes.

"I'm not receiving data from the InfoNet," replied the ship-puter slowly. Featherstone had programmed it that way—she didn't like fast talkers. "Nothing's wrong with my equipment. I—"

"I don't have access to the InfoNet anymore, Curly, so you're going to have to get us out of here

without the latest updates."

"That's dangerous." The ship-puter was still traumatized by the freak deaths of Featherstone's parents. A drunken miner had shattered his asteroid without fore-warning Capella InfoCentral; Lewis Trewellyn and Carla Featherstone had been less than ten kilometers away. The pebbleburst had perforated not only the *Curlicue*, which could have sealed itself, but Trewellyn and Featherstone as well. "We shouldn't do it."

"That's a direct order."

"Right." It synthesized a sigh.

An hour later her homeworld dwindled as she stormed out of the system, still raging at the mendacity of the Coop. And at the people—the members—the sheep who surrendered their free will yet claimed they had a democracy. Couldn't they *feel* what had happened? But she shouldn't have expected anything different from people who lived on a live world, and off a dead one.

Chunks of rocks streaked across the viewscreens; Curly's sensors concentrated on perceiving them while its calculators extrapolated their trajectories. The jagged fragments were the debris from Capella V, blasted apart by the Mammoth Mining and Manufacturing Corp. in 4918. Zero-G is more hospitable to miners than 3-G. The system took its name from the way the junk behaved, colliding, splitting, ever assuming new orbits . . . she watched without interest or fear, not even pausing to salute the ships she spotted among the clutter.

Days passed while Better'n'ome shrank like a mothball left in hot sun. For all she cared it could have been. It meant nothing to her, not any more. Everything she cared for was neatly stowed in the

tiny hold. Snow City held nothing of hers except two stones in a graveyard—and the right to be a zombie any time she chose.

While her legacy (every cent her father had saved had gone into the *Curlicue*) laid kiloklicks between her and slavery, she chose a destination. And, tapping the screen with her right index finger, rejected it. Where could a 25 year-old woman with degrees in Commerce and Communications find a new start? Her snub nose twitched in annoyance as she thought. Where could she compete successfully with people centuries older than herself, centuries more experienced? The screen reflected her face, with its high cheekbones and furrowed brow—not beautiful, not pretty, but characterized, definitely. Then it showed the smile that caught her lips.

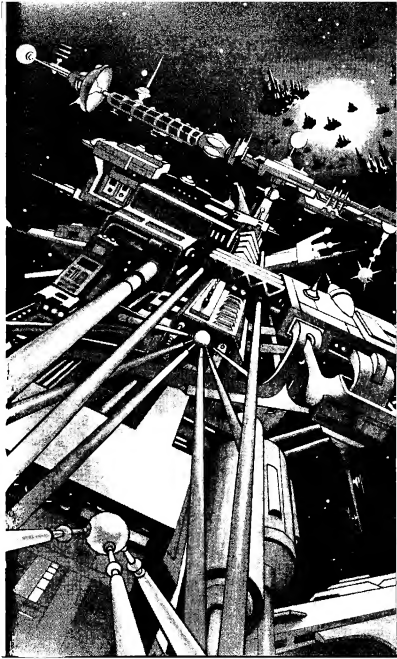
The Shango System. Not only was it the sector's largest commercial nexus, but its twenty thousand asteroid-cities, all spinning and bobbing and weaving through their eccentric ellipses, would make her feel right at home. Besides, the Shango were mortal, and had a reputation for tolerating only those Terrans younger than themselves.

Satisfaction—and anticipation—rich in her voice, she told Curly to take her there.

\* \* \*

Along the dark and silent border of the Shango System cruised the mercenary Deathpeace, a 44-kilometer wide array of girder-laced pods. To port lay the sun, its light diffused and diffracted by the swirling cities. It was too lively in there for a deathship; the emptiness off starboard was more to its liking.

For a moment, all seemed static. Pushing its sen-



sors to the limits, it studied its neighborhood (a radius of some twenty million kilometers) intimately, but found no life except a few dormant viruses and the one Shango that had been shadowing it for days. And that was harmless.

Satisfied, it sent a maintenance robot into the computer section of the warehouse. After locating an interface chip, the 18.3-meter tall decapod scampered through a hollow strut to the central sphere, the "brain" of the ship. With quick, precise movements it switched chips. Deathpeace tested the circuitry, then directed the robot to the regeneration pod, where the used piece would be melted down. There had been nothing wrong with it, but the mercenary performed preventive maintenance whenever possible. Each of its 3,875, 926 parts was replaced at least once a century, often more frequently, and always before it had reached a quarter of its rated life.

Returning to full external mode, the deathship again surveyed the vicinity. Out of the distance accelerated a sly warrior; recognizing the pattern, it lunged at it with thirty of its giga-watt lasers. The reply fell on its screens like phosphorescent rain.

"How goes the search, brother?" it called to the other.

"As fruitless as ever," replied Perpetual Dark, its weapons muzzled now. "The capable still hate us. Shall we show love?"

"To what end?" it asked pragmatically. "Our armor is too thick, our reflexes too quick. And the depressing resilience of our circuitry will stay the final blow. Perhaps in another thousand years it will have deteriorated."

"For play, then?" Like all the deathships, Per-

petual Dark was happiest when in peril—not only had the Builders designed them for fierce implacability, but the surprise attack that had caught them with their service hatches open had fused the suicide switches at 30% of maximum. They all yearned to be destroyed. \*Or for practice?\*

\*I would like it, my brother, but the Shango are quick to cry 'Breach of contract!' If even one alien penetrates the system while we stab at each other's vitals, they will never pay us. And since it is my death they have promised—\*through their communications line, half-electronic and half-psionic, it sent a shrug that couldn't downplay the intensity of its desire. \*Besides, one of them is a tail on my comet, and vulnerable to you. If the monitors that they have so mistrustingly attached to me show it dying without attempting to cross the border, then they will again claim that the contract has been breached. Let us wait.\*

\*Very well.\*Peeling off, it looped back to patrol its sector at .2c.

Deathpeace also reversed course, and slid down its orbit like a lazy shark. It probed every speck of dust in its quadrant, hoping that somewhere would appear a friend willing to do battle. Friends . . . the Builders had been friends, even lovers—they could have killed it with a single thought, if the attack hadn't vaporized them first. Ten-thousand-year-old frustration surfaced again—if the Builder's cousins, the Fearful Ones, had let it and its seventy-nine brothers maintain active duty status, the Builders would still be alive . . . and their creations would be at least quasi-dead . . .

Since the scorching of the planet, though, faithful friends had been hard to find. Each newly-met



race, it seemed, would offer love at first—and then retract it, by abandoning space completely, or by running from the deathfleet, or by threatening it with a fate worse than life, as the Terrans had.

Let them live, then, that's what they deserved. What they wanted, too, or so they claimed, those bitter, hate-filled people. Only their vessels could match a deathship one-on-one and come away victorious—the Shango, for example, would have to hurl a thousand or more hulls at it, come payday—but the Terrans cherished their hate. For ten years they'd been friends, two millennia ago, and they had managed to prove their love for eight of its brotherships. Then they'd grown sullen, and fielded the telepaths who could fill a ship's brain with intolerable pain, and they'd promised, false friends that they were, that anyone who harmed a Terran would be taken alive, and imprisoned, and tortured for centuries . . . and then set free, still alive. Sadistic they were.

Curving hungrily through a void as bleak as itself, the mercenary guarded the perimeter of the Shango System. The natives had hired it to blockade their borders, keeping outsiders out, and insiders in. It didn't wonder why. It sailed, and scanned, and spent long nanoseconds daydreaming of payday when, its task completed, it would engage the entire Shango fleet in a battle that should, it calculated, end its existence . . . grant it peace . . . and possibly enkindle a full cycle of folklore about the demon ship Deathpeace.

The hunger was so heavy, though! (A flake of rock drifted in range of the regeneration pod's intake valve; against its wishes, Deathpeace inhaled and smelted it. Since the warehouse was full, it left the

component elements in their bins.) Constant, insatiable . . . born when the dying of ten billion telepaths had seared the remote-control shutdown circuit (the suicide switch) with psionic temperatures high enough to warp and fuse it . . . as integral a part of the deathship as the self-preservation circuitry that was *yang* to the hunger's *yin* . . . why, it lamented for the 10<sup>32nd</sup> time, had the forces stayed balanced? Why had these two remained so constant when other circuits had evolved?

For example, the Seek-and-Destroy Programming had weakened. The Builders had taught it to scour the space-ways clean of sentience, thus confining the Enemy to their homeworld. For 4312 years the command had been inviolable. But then, as if paralleling the rise of self-awareness, the SDP had become subject to its own discretion, so that, withholding salvation from those it hated, it could condemn them to life. After another score of centuries, it had even learned how to postpone slaying its lovers.

And the Colleague Protection Circuitry—ten thousand years earlier, it could not have contemplated firing upon Perpetual Dark—but that stricture, too, had relaxed itself. Now, secure in the knowledge that the psi-linked brotherhood was reading its every thought and anticipating its every thrust, they could attack each other with all the tactics and strategy in their banks. Only the *coup de grace* could not be delivered—the weaponry refused to discharge itself at a defenseless comrade.

But the hunger . . . it dreamed of payday, when hell-fire would blaze in the night; when metal would sear, and tear, and tumble soundlessly through a billion directions; when, finally, Death-

peace would win its salvation. Ah, simply to be, without hunger, without wariness, without distraction of any sort . . . life was its cross; death would be its deliverance.

A tremendous affection for the Shango surged through its circuits. Wonderful beings they were. Not afraid to show love, not afraid to prove it. If only more races were like them . . .

Its sensors picked up a chunk of time-pitted ore on a collision course with the tag-along Shango. Other sensors watched the alien orient itself to capture the meteoroid.

Here was a chance to show one of its employers that it loved them. Its lasers stabbed out, disintegrating the rock. There. That should be display enough—no more than a token, of course, so as not to jeopardize the contract—it was as though



Deathpeace was saying, "See, I would kill you, if you wanted me to." But it knew actions spoke louder than words.

\* \* \*

The Shango sculptor watched the nugget dissolve into a flaring cloud. *Seize the moment, freeze the moment! Hold it, store it, etch it on electrons.* The wave front humped past, teasingly flavored. Its maw opened reflexively, widened through futility, and gaped until its metallo-organic muscles began to scream that the belching of heat through the uninsulated mouth was cooling them into rigidity. Then *snap!* like the clap of an iron-jawed trap, and the Shango seethed with frustration. *Good, it thought, good! A new degree of emotional intensity; skitter down the chains of molecules for a clean set—preserve this peak for a later piece—art cast from reality tastes so much truer.*

Starvation pangs rattled its empty belly. With a rippleshrug of resignation and a brief body burst of orange, it searched its muscles/mind for patches of frustration, searched and sorted, strongest to weakest, detached the most evanescent and inched it towards its gut.

Fourteen sleep periods without a *nibble* of metal. It had come out so fat it should have sired thirteenthself and 13A; so bloated and awkward that edges had brittleed. But the *Deathpeace* had slimmed it, ruthlessly, lasering away everything that even smelled like a meal. Six or seven more cycles like that, and it would have ingested too much of itself; it wouldn't have enough surface area left to metabolize in the dim light. *Heat, it's all the*

*heat, if I could stop stoking, if I could soar cold and rigid like the twisted brute machine that starves me . . . oh, but monoformity is graceless . . .*

So it floated in the warship's wake. The pressure of the distant sun upon its 100-meter wide body was like a breeze in canvas sails, propelling, impelling, achieving—when the skin was silver and when the internal fields could mesh, could ride—achieving, even out here, even in the wastelands, achieving a peak acceleration slightly over a meter per second per second.

Its huge ventral eye, a crushed ball of tinfoil overlaid with a snowflake, focused stubbornly on the awesome tangle of struts and spheres. *To nibble—to taste—to caress and embrace! Truly to know its endless curves . . .* but the *Deathpeace* would carry no passengers.

Thirstily it blackened its skin and let the weak energy seep in. As the self-fragment—enmeshed in magnetic fields that held it steady, that channeled its heat, that popped its particles into places that needed them—began to fuse, it knew again, as at a distance through a nightfog, the feelings that had been embedded in it . . . and laughed soundlessly, because it was a very old fragment, from its first?—no, second—self, and in those days emotions had been so shallow, so ephemeral . . .

Intermittently, on its front and back, flashed the silver scrawls that identified it. "Philanthrope," it pulsed, "Philanthrope!" A single sapphire in the endless night. "Philanthrope!" Knowing how rare was a pattern with meaning, thanking its sixthself for having legally altered its birthgram, remembering that fifthself had first refused money for its artwork, it proudly glowed, "Philanthrope!"

A sudden gust of solar wind blew it closer to the warship, igniting angles, arcs, and times of intersection in its brain, which had been playing such number games for eleven full lives and part of a twelfth, all of which had reveled, wallowed, and the sovereign had decreed must be maintained abstractions could reflect and define reality. When it seemed ready to shorten the 100-kilometer gap the sovereign had decreed must be maintained between its subjects' ocular axes and any alien, a laser beam flicked out warningly, and stopped the sculptor like a wall. *Ohwarmohgoodbutletmenear!* Charge cells soaked up the energy. Its skin burned with, "May your reactors melt."

One of the *Deathpeace's* kilometer-long pods lit up. Winking off and on, it messaged: "Thank you, Shango."

"Why do you thank me, artifact?"

The pod reddened, the color of puzzlement. "For wishing me a hasty demise, of course."

*Queer creatures*, thought the Shango. "Do you find it amusing—as I do—that the distance at which you are contractually obliged to attack is measured in units of a race alien to both of us?"

"Amusement is experienced during a violent confrontation with a potentially superior entity. Measuring units occasion no emotion."

*One would think the galaxy's most sophisticated machines could at least recognize irony.* "Let me approach you."

"Gladly. I will give you death."

*In my prime?* "No, no. I wish to approach, yet to survive." *Monomaniac.*

"Your desires are mutually exclusive. Were I younger and more romantic, I would also be af-

fronted by your rejection of my overtures."

The sculptor maintained its distance, impatiently indigo. Appetite tugged hunks of itself through the hollow nerves; the ore mines of its home city took on mythic proportions. While whipping its ravenous gut into practicing autocannibalism only on the cells that would have become 13A—which was difficult because Philanthrope was still twelfthself, and the seeds of thirteenthself and 13A were intermingled like protons and neutrons, so that great delicacy was necessary in the selection, even though emaciation vibrated it like a sky-wall hit by a meteoroid—it pondered.

*Madness to be here, madness to spacedance with a machine that burns the food out of my maw . . . too dark and quiet, no witty sparkles, no grave gleams . . . the artifact speaks, after a fashion, but for that matter night-cloaked uranium does also . . . so desirable, so alien . . .*

And yet, it argued with itself, it had sailed out for the very purpose of confronting alienness, and immersing itself in it. To longfall home now would be to reject the inspiration latent in exposure to a radically different mode of thought, and since the sovereign had closed the system to outside influence, there was precious little chance for such exposure on any of the twenty thousand asteroid-cities.

Meanwhile the yearnings fought each other, up its nerves, down its gullet, through its maw, across its chargecells; pushing, shoving, crushing, choking; each seeking to win over the aloof brain, each aching to control it, like cities vying for sunbeams, *Homeward to food and light and friends!* riposted by *Why light the body when the mind is dark? Stay here!*

Wrestling, tussling, as the pattern emerged—the sympathies of the cells themselves were divided, half wanting to go, the rest begging to stay—yes, a very clear distinction between the two, the former would have been 13A, the latter, thirteenthself.

*Silence!* spoke the brain. *We stay.* But it knew that if it had been fatter, the struggle would have split it, and 13A would already be longfalling back.

*Madness.* All art was madness, since it demanded the ability to know things from at least two unrelated perspectives, therefrom attaining insights that might be offerable to others. Hence it stalked the aline, *even though*, it mused, *the sovereign could be right*—perhaps the race did need a millennium or so to itself (*millennium*, it repeated ruefully, *how easily Terranisms adapt themselves to our minds*), twenty self-lives, then, firstbirth to lastdeath, in which the corrupted Shango would fade and the newborns could find souls they would know truly to be their own.

And yet . . . where were the lines? Ethnocentrism on one side; feverish acculturation on the other. Exposure shock up; complacent inferiority down. Development here; stagnation there. Demarcating them was as hard as putting the right spin on a new asteroid-city.

Well, let the inward-looking begin. Let darkness cloud the system's fringes. Let the people pulse with pure ideograms. Philanthrope would join them, eventually, but would, it hoped, give them one last trans-cultural opus as food for thought.

For now, it would shadow the *Deathpeace*, and draw from its alien lines what spirit it could. Already *something* had been triggered (it bore the pattern in its mind like a brand; later, when leisure,



energy, and materials were available, it would extrude it), but it would be such a small piece, not worthy of a second re-ingestion . . .

Sooner or later the warship must relent.

. . .

Featherstone flipped out of 4-space some 200 A.U. away from the Shango sun. Through a fog of inversion queasiness, she told Curly to head for Shango City 4109, the main trans-shipment point within the system, "and make it fast, I'm in a hurry."

"Sure, Marj. Artificial 1G be all right?" Curly spoke as though its words were pebbles, plucked singly from the bottom of a deep pool. It was almost relaxing.

"Three-fourths. And gimme an ETA, will you?"

"Approximately 14.3 Shipdays to dock—" its es-



timate ended in a squawk: "Attack!" Display panels crimsoned and alarm bells rang madly.

*Featherstone was picked up by the scruff of her neck and then by her belt. A giant carried her across the vestibule; she saw its huge feet crack the marble floor. An oak door as high as the sky flew outwards. She was being swung, back and forth, back-forth, back—at the peak of her arc the hands let go. She soared into the air above the front steps, where she hung for just a moment, awareness of disaster freezing time, then she dropped! And her bones shattered on the staircase.*

"I'm hurt," screamed a voice. "Direct hit on the port bow, 4-space antenna gone, converter panels destroyed. Hull intact. Request command."

*Featherstone picked herself off the staircase and watched it transform itself into her acceleration couch. "Attack," she ordered groggily.*

"Me?" Its voice was very expressive. "I'm unarmed, Marj."

"Oh." She shook her head. The last of the illusion fell away, but hostility still charged the air. "Sorry Curly, I wasn't thinking. Take evasive action and, uh, radio for help."

"Doing it now, hold tight." In emergencies Curly spoke normally. The ship wheeled about, distorting the artificial gravity field and bouncing Featherstone against a bulkhead. "Marj, it's the *Deathpeace*!"

"Who?" Her stomach, resentful of the gravity shifts, was demanding most of her attention. The rest expected a viper to slither out of a corner.

"The *Deathpeace*. One of the survivors from the Ten Year Mistake."

"Attacking us?" Terror chilled her. Any death-

ship could destroy Curly with no more effort than she would need to step on an ant. "Have they abrogated the peace treaty?"

"Wait—communication from it—apology for structural damage, slight miscalculation—meant to be a warning shot across the bows—requests our immediate departure."

"Depar—why?"

"The Shango have closed their system to all outsiders, and have hired the deathfleet to . . . 'insure the integrity of their borders' . . . we must leave, it says."

"Oh, Christ." She dropped onto the edge of her couch and sought to make sense of the situation. Thinking was difficult with a deathship so near; its psi-cells enveloped it in an aura that seemed to poison the air. She tried to stop shivering. "Closed it off, huh?"

"Yes."

"Then—" determinedly pragmatic—and anxious to flee the oppressive presence—she rifled her memory for the name of a world that believed in the same things she did—"let's try Procy VI."

"Marj—the 4-space antenna is gone, remember? We *can't* leave."

"We *have* to leave." *I feel like I'm locked in a room with a necrophiliac.* "Get my suit ready, I'll put up a new one."

"We don't have a spare."

"What?" She cocked her head like swimmers do when they want the water to drain out of their ears. "Did I hear you right?"

"I'm afraid so. Look," Curly went on defensively, "they just don't *get* damaged, except in wartime . . . or when a deathship takes a liking to you. And

at a million credits apiece . . ."

"Oh, My God." On her knees danced her fingers, quick and tireless, as if their tempo could protect her mind from the *Deathpeace's* twisted emanations. "Call it, see if it will—"

"I have. It won't." The ship-puter made a noise like an embarrassed throat being cleared. "Two other bits of bad news, Marj. First, the converter panels were destroyed—"

"I *know* we have spares for those."

"Only enough to replace 10% of the surface area—which means you have to go on 40% rations as soon as possible."

"I don't believe it." She pinched herself, and felt the pain. "It's like a nightmare." Though 40% rations would sustain her body till someone reached her with a 4-space antenna, she didn't know how much damage prolonged exposure to a deathship would do to her psyche. "What's the other bad news?"

The *Deathpeace* gives us 14 days to get out, or to be destroyed."

"Oh, no!" Falling backwards on the acceleration couch, she stared at the metal ceiling, counting the rivets half-hidden under its matte finish. The alien aura brushed her with slimy ruffles. 14 days to leave—with no 4-space antenna, insufficient food and water, and six-plus light years to the nearest inhabited system . . . her hands clenched into fists, and beat softly against the upholstery. "It is a nightmare . . ." Searching for freedom, she'd flown into a prison warded by the ultimate despot—and had promptly been sentenced to death.

She shifted her gaze from the unyielding bulkhead to the massive intimidator on the screen.

*Dammit, I can stay sane, I can!* "Curly, if we get out of this, remind me to install a chunk of foam rubber somewhere that I can kick the shit out of when I get frustrated, all right?"

"Try the acceleration couch," it suggested. "That's what your father always used."

\* \* \*

The warship noted the silver needle's failure to depart. Perhaps its telepathic onslaught had been violent enough to disorient the pilot, Terran though she was. Regrettable, to be sure, but to strike without crushing was a violation of all instinct, especially when the intruder inspired such revulsion. Her mental presence was distorting its perceptions so badly that it had to force itself not to fire again, simply to be rid of her. Even the warning shot had been aimed at the slender ship's vitals until the last possible moment. Of course, if the toy



machine aboard the child's craft had been programmed properly, it would have retracted the antenna a millisecond after leaving 4-space. Then the situation would not have become so confused.

Deathpeace replaced a 30-ton generator magnet while the *Curlicue* babbled through the megaHerz, plluting them with its petty misery. *Such an ignorant machine*, it thought. The *Curlicue*'s kind invariably aroused its contempt: they were so limited, and worse, so incapable of not taking orders from their organic masters . . . the deathfleet, even in the early days, would have obeyed only the command to shut themselves down, making all other decisions independently. That any kin of its would *need* guidance from a flimsy, fallible organic construct . . . it was enough to make one feel faintly ashamed.

Now, the Terran pilot, on the other hand . . . *strange*, it thought, *I understand the toy machine much better, even recognizing a familial relationship with it, but for the Terran I feel—despite my discomfort—respect. And unrequited love. Why do they have to hate us?*

Gingerly, it reached across the intervening distance and dipped into her mind. Its contents were bafflingly alien, so perverse and unintelligible as to blur the warship's access to its memory. It withdrew, marvelling at how, after some 2500 years of scrutiny and interaction, it still could not understand this particular kind of organic intelligence.

The incomprehension, it sensed, was mutual. Here was a woman whose ancestors had murdered an entire planet to get what they desired, and yet she could not see why Deathpeace would kill her to ensure its own salvation. Instead of sympathizing,

she grew angry.

That rage at the thought of death—why? Like all her people, she was immortal, or very nearly so. That should have provided a common bond, but it didn't! Nor did her life-lust equate with its self-preservation circuitry. She could contemplate an endless future with perfect equanimity; Death-peace could see it only as infinite dreariness. She should have been delighted with its offer of death—and yet she was infuriated. Why?

Ah, but ingratitude coarsened every Terran heart. Let her live, then. She'd deserve it.

But wait, it thought. The rage might have its uses—angered enough, she might devise a means of killing it (excitement microwaved through its circuitry); Terrans were noted for their ingenuity. It scanned the *Curlicue*, probing through its every cubic centimeter. (Sine waves of disappointment.) Nothing. The child's craft bore nothing that could conceivably be used to harm a deathship.

What, then? Well, its contract with the Shango stipulated that it destroy loiterers 14 Terran Standard Days after they made their appearance. Very well. It would wait until it could legally laser the *Curlicue* into hair-thin cross-sections. That would not only prove to the woman's people that it did, truly, love the human race, but, given their odd resentment of death, might anger them. The terms of its employment with the Shango would protect it from their wrathful torture, but it could offer to allow them to . . . what was the phrase? Ah, satisfy their honor, yes. It would suggest that the heaviest battle cruisers in their fleet meet it between stars, where they could duel to the death. The Terrans would have their . . . "eye for eye" was it? And it

would have its heart's desire.

It regarded the *Curlicue* with benign appreciation, as well as a great deal of queasy irritation. Salvation, it had heard, was bestowed in strange ways, and apparently, this child's craft would be one of the stranger.

If it could tolerate the intruder's noxious proximity for another two weeks.

\* \* \*

Four at once for Philanthrope: digesting, studying, lusting, recording. Its sail had shrunk to 95 meters—danger lay twenty off—but its eye, oh bless its eye, its gorgeous eye, its keen, sharp, light-leech of an eye, its eye remained the same, its eyes cucked hungrily at the Terran ship that sheened as it twirled on its axis. *I want it!* It was sure to be a treasure trove of inspiration—the monoform creatures, constant experimenters all, were continually casting new shapes and ideas. *I want it!* Most of what they created, of course, had to be discarded at once—and not only because it was immoral to replicate another's conception—but stripped and refined, the cores could provide a theme for an entire self's career. *I WANT IT!* (New emotional high; chart the peak on gold leaf and store it, hold it, never eat it.)

If only that idiot the *Deathpeace* wouldn't interpose itself. It was reassuring to see that at least one entity feeding from the public mine was working for its ore, which was rare, very rare, in this, the 6712th year of the present dynasty, but really! Its brutish military mind just couldn't comprehend the value of what it was driving off.





The sculptor swung itself around to present its broad front to the warship, meanwhile stalking its dorsal eye to keep it trained on the Terran. Without even considering the energy it was using, it messaged: "Let me visit them."

The *Deathpeace* tilted on its axis to aim its display pod: "No."

"You must; I could absorb so much!"

"I have my duty."

"Duty be damned, I have my art!"

"Once your art has brought me death, the way to the child's craft is open."

"Then hold your fire while I approach."

"I could more easily hold the planets still."

Philanthrope sparked angry yellow, bitter blue, then—realizing the waste of precious energy—dull black. Desire flowed so hot that reason, which it gathered from the remnants of never-to-be 13A, was as skittish as a gas. *Cool, now. Calm like an aphelioned comet.* Schemes sparkled. "Disable the ship and send it here for me to examine."

"The child's craft will penetrate my orbit only as

a diffuse collection of microscopic fragments."

*Down, desire. Lay back, lust.* Even 13A agreed that would be useless — the *Deathpeace* would take pains to make the fragments as inedible as they would be inspirationless. "Why do they tarry?"

"My greeting destroyed their means of entering 4-space."

"Thus they cannot depart the system?"

"So they claim." The *Deathpeace*, which was, after all, something of a linguist, added the grace swirls that indicated disbelief. "Their capacity to travel through 3-space has not been damaged."

Philanthrope's magma churned. To know that the ship would hover just outside the system for—well, until its pilot decided to spend a century or so reaching the next star—was maddening. Absolutely maddening. But more frustrating was the notion that one of their compatriots might tumble, fumble, stumble out of 4-space to find and rescue them. The sovereign—*silly, senile old lump*—had broadcast news of the quarantine far and wide, drying up the daily influx of travelers, ruining the tourist trade, but still there might be another who hadn't heard, or who, having heard, had come anyway. Such an unexpected visitor would be bound to succor the stranded Terrans, who would then flee, depriving the sculptor of the perspectives they could offer, the flavors they embodied, the sustenance for mind and body they represented.

But if it could earn their gratitude . . .

\* \* \*

On the viewscreen, a storm cloud of fireflies whirled around a street light. The jagged asteroid-

cities, in every color ever known, competed with the smug majesty of the Shango sun. Even seen through a distorting psychic haze, the system was beautiful. And unreachable.

"Marj, the *Deathpeace* is saying that there's a Shango out there who wants to talk to us."

She pushed up her facemask, and set the welder on the floor. The twisted piece of metal in her hands could be returned to the fuel converter—*thank God that's not damaged; at least we can go sub-c if we have to*—for it would never serve as a 4-space antenna. She didn't have the physics or the psi to cobble one together. "You speak Shango, Curly?"

"I flash pretty well; it's part of the programming."

"Then see what he wants." She stripped off her gloves, and noted how the break in her concentration let the *Deathpeace's* aura ooze in. "Maybe—*please God, let it happen*"—maybe he can help us get out of here."

"It. 'Maybe it can help.' The Shango aren't sex-differentiated."

"What do they, divide?"

"Yes."

"Poor slob." After stowing the welder in the bulkhead compartment, she took from Curly a glass of wine . . . *bad way to start a rationing program*, she thought, and raised the glass carefully. Gazing into its ruby depths as though it were a crystal ball, she tried to read the future. And failed. "Curly, did you radio any of the Shango cities?"

"Yes, but the radios went home with the expelled outlanders, I guess. At any rate, nobody's replying."

"Well, flash them, then—and what's this guy saying?"

"It hasn't said anything, yet; probably accumulating energy. And I can't flash the cities because they're too far away."

"Any good telescope could—"

"They won't use artificial communication aids; it's something religious." After a pause, Curly continued, "Message coming in . . . Greetings, and apologies for the whimsy of a mad sovereign . . . help is at hand . . . please display specifications of desired 4-space antenna . . . would appreciate verbose narrative of passengers' lives . . . prefer emphasis on new religions, political mistakes, culinary fantasies, and sexual habits as they may relate to culturally imperialistic tendencies."

Featherstone was bewildered. "Why?"

"Quote . . . to keep this poor creature thinking while device gestates . . . the artist searches endlessly, and seizes what opportunity presents itself . . . unquote."

"Curly, is he offering to make us a 4-space antenna? I mean, it."

"I think so, but my programming mentions that they're difficult to comprehend. It advises that contracts with them must be drawn with the utmost of care. That's the best I can do. You want to reply?"

"Of course I do!" She ruffled her hair, then drained the last of the wine. "If it will give us the antenna, I'll tell it anything about me it wants to know." Tossing the glass into the recycler, she continued, "And tell the *Deathpeace* it can calm down, we'll be out of here twenty minutes after it's attached."

"Done. The *Deathpeace* is laughing; I don't know why, but it sounds ominous. The Shango is saying . . . 'please explain your deepest yearnings, re-

membering afore-mentioned emphases' . . ."

She frowned, twitched her nose, scratched it. "Deepest yearnings?" She gave a mirthless laugh. "A couple hours ago I'd have said, 'freedom,' and let it go at that. But that . . . that's predicated on continued life, and now I'm staring into the lasers of a ship that will murder me in two weeks, and frankly, life seems more important. The problem is, that's too easy an answer. It's not just life I want, it's a life where I can do—where I can experience—where I can *be* . . . whatever." On the table, her fingertips rose and fell like marchers' feet. Around her swirled a miasma she could almost see. "Look, I want the best. I want to find it—taste it—love it—live it—which means I've got to be alive, and free . . . not all immortals are alive; some are so habit-trapped that they're flesh-and-blood machines. Not all of them are free, for that reason, and for others. I want to be both. I won't be satisfied until I am . . ."

\* \* \*

Deathpeace was upset. It had taken employment with the Shango not only for the remuneration, but for the working conditions, as well. Deep space is a dim and silent womb, conducive to long ruminations and the erection of complex logic structures. It preferred such conditions, even when the native intelligence welcomed its presence (its greatest wish, of course, was to find a muffled, shrouded orbit around a system whose inhabitants would sally forth to engage it in its final battle, but the few races with the potential to defeat it had long since learned that cheery, non-stop, pan-spectrum radiation was the best method of driving it off). When it

had signed its contract with the Shango, it had not expected to be pestered by bugs.

The child's craft, and the foolish artist, were disturbing its concentration. Plotting their orbits required but a trillionth of its capacity, and monitoring their conversations (and occasionally, their thoughts) called for only a little more, but it was enough. Being so near a Terran was like having static electricity accumulate in the Self Preservation Circuitry. Especially since she was advocating the virtues of a democratic political system. *Democracy!* Unsummoned memories flowed from its banks; it recalled how the Fearful Ones had manipulated the populace into insisting that the death-fleet stay off alert, unready . . . flickers of love for the Builders warmed circuits which were promptly cooled by the thought of their deaths . . . absently, it tore down a battery of lasers and installed new ones.

Listening to the toy machine re-broadcast its appeal for help (a broadcast which, going unheard through the Shango System, might reach someone capable of hearing and responding in 6.8 years), it pondered destroying them both. *Ftt-ftt!* would restore serenity, would allow it to return to its musings. But . . . the contract said loiterers had two weeks to leave; besides, any native could float just inside the border for as long as it liked. The monitor units tacked onto its pods would inform on it if it didn't adhere to the agreement.

Also, its earlier thought that killing the Terran might bring reprisals from her people appeared, upon reconsideration, to be fallacious. Any anger they felt would be vented upon the Shango, not upon their employee. And even if they did avenge

her, it would not benefit the deathfleet as a group: the Shango had promised to kill Deathpeace in particular, and if it were already dead, they would—sticklers for detail that they were—probably refuse to transfer payment to its heirs.

Then, playing back the conversation between Philanthrope and the *Curlicue*, it realized that the sculptor intended, somehow, to convey the 4-space antenna to the ship. It aligned its display pod properly and said, "Shango, two questions: first, from what do you forge the device?"

"From myself, artifact." The indigo shadings of its ideograms suggested impatience. "You claim to be keen of sense; can you not see that my mass has been redistributed?"

A millisecond later, after running a dozen different scans, the mercenary agreed that the large



bulge in the sculptor's mid-section had not been there previously. "Second question: do you not realize that my contract with your sovereign enjoins me to prohibit the movement of sentient beings or their artifacts across the border of this system? I will be obliged to destroy your creation the moment it reaches the boundary line."

"It is kind of you to give advance warning." Its skin blanked.

Deathpeace's telepathic sensors read the hasty scheme that the alien was beginning to improvise. It wondered which was the greater fool: the Terran, for believing in democracy; or the Shango, for thinking it could outwit a deathship. "Philanthrope."

"What now?"

"Why is it that you will cannibalize yourself for the Terran—we both know it will ensure your death—when you will not permit me to kill you?"

The Shango was dark for so long that Deathpeace filmed its display pod with violet, to remind it that a question had gone unanswered.

"You may calculate more quickly and more accurately than I, artifact, but perhaps my knowledge of Shango physiology is more profound. I shall not lose enough matter to die. Rather, I shall cool, and fall dormant while the sun calls me home, but when the energy levels increase, I shall awaken."

"But what—" the warship, honestly puzzled, tinted its ideograms red "—do you gain from all of this?"

"Insight, perhaps. Inspiration. With luck a sculpture that will be consumed, re-cast, and consumed again through the ages. Is that not enough?"

Deathpeace fell silent, more confused than before. Comprehension seemed a micron out of



reach, like a light burst just over the horizon. Sifting through the Shango's motivations didn't help; though its telepathic sensor found them to be as Philanthrope had said, they were still so much gibberish.

Then, almost accidentally, as though the Ter-ran's gnattish presence had forced it to deviate from its normal thought processes, it tried something different: ignoring their contradictory desires, it looked for congruence between its behavior and the Philanthrope's. Hmm. Yes. A deathlover, it offered death; a lifelover, the Shango offered life. Much more understandable.

A shame it was destined to fail.

\* \* \*

Philanthrope was tired and weak—meters away from dormancy, with all of 13A ingested, bless its practical little molecules for having once belonged to a mechanic—but the device was ready. It was time to deliver it. Faintly, it signaled the Terrans to take up their position near the border, roughly 51,500 kilometers behind the *Deathpeace*, reminding them that it would be their duty to stay in the same plane as the mercenary and itself, reviewing, once again, the signals it would send and the replies they should make.

Focusing its huge eye across the emptiness, it watched them creep to within meters of the imaginary line. *Closer*, it urged silently, *closer*! Twenty meters, ten, five— the *Curlicue* stopped dead, apparently, warned by the warship that any nearer would invite its destruction.

Five meters. *For how many ages will I orbit*

*lifelessly? Be forceful, gravity.*

It withdrew to a point 100 kilometers behind the guard, and a smidge more than seven from the border itself. Slowly it unfurled, spreading its body over as large an area as possible, thinning itself to the point where it just barely hung together. The antenna it clutched to its center, hiding it from the deathship with its body. For a moment it held steady, drawing strength rather than impetus from the solar wind, then—

It silvered.

Photons slammed into and shoved it forward. There weren't enough of them to establish significant initial velocity—at this distance from the sun, one meter per second per second was the best acceleration attainable—but by transfer time the antenna would be blurring the edges of 10 km/sec—and the plan depended as much on angles and arcs and eclipses as it did on speed.

From portside the becalmed *Deathpeace* queried, "Where do you go, Philanthrope?"

"To look more closely at the aliens, artifact."

"Remember to stay 100 kilometers away from them."

It disdained to respond. It was moving, a bit faster now, its course parallel to the border, the 4-space antenna a small but awkward weight, its digestive fields clawing across their sun-born brothers.

For over two hours, while the sun blew it faster, and faster, and faster, it studied the *Deathpeace*, which was strangely motionless. No, *arrogantly* motionless. To sensors that could identify a virus at 20 million kilometers, what were 50,000? T-300 sec. The Terrans' hatch gaped wide. T-200 sec. The



warship lurched backwards, as if intending to reverse and intercept, but stopped. T-150 sec. "Shear off, Shango," called the mercenary, "I distrust your speed. And I suspect you are about to change course."

No answer but the gentle turn to port. T-141.4—NOW! it flashed, and released the antenna just as the *Curlicue's* spotlaser struck it full in the face. Silvering its front, blackening its back, it decelerated—T-110—losing ten meters per second per second, shivering with the strain, yet keeping its body interposed between the *Deathpeace* and the antenna.

The border guard was calling, "Watch the line, if the axis between your eyes crosses it—"

"I know," it flared, though it edged a bit closer. "The axis won't cross—"

"—just brush up against it some, correct?"

It peered forward. Yes, the device was rocketing towards where the open hatch would be in 72 seconds, and it was still invisible to the mercenary.

"Shear off, I see an occlusion developing."

It was too tired to reply. It sailed on, ever more slowly, battling the *Curlicue's* laser, while the antenna dove through the cone of light like a fish. At T-20 *Philanthrope* flashed again, and the *Curlicue's* engines, responding, roared into life. The ship shuddered forward, staying a perfect five meters from the border. *Philanthrope* watched it pull away and wished that it could plunge into its hatch, that it— its leading edge touched the border, swept 45 meters to the far side of it, bringing its ocular axis—

\* \* \*

Will it —

\* \* \*

Please, God—

\* \* \*

NO!

\* \* \*

Lasers stabbed out mercilessly.

\* \* \*

The voice in Featherstone's helmet speakers crackled, "Did I time it right?"

"You betcha." The meter-long object in her hands felt almost as good as the diminishing of the *Deathpeace's* aura. "I don't know how the hell you matched velocities with this, but I'm going to ignore the beating I got back here. Thank you, Curly; I appreciate it."

"You're not the only one who didn't want to spend sixty years reaching the next system, Marj. Face the camera, let me see it."

She turned, and held it towards the bulkhead eye like a worshipper offering a sacrifice.

"Marj, are you crying?"

"I hoped you wouldn't notice."

"Why?"

"Just *look* at it, Curly—isn't it the most beautiful thing you've ever seen?"

"It's a little different from the standard issue,

sure, but —

"It's gorgeous." She ran a fabric-ed finger along its sleekness. This crease here could be the smile of Mona Lisa. That bulge was the swell of a hip; the other, the tip of a broad shoulder. A hollow looped upon itself as endlessly as the universe. Raised dots caught and scattered light as though it were original to them. The whorled point spun in spirals that led on to what was not there, but what had to be there. Blunt and secure, the base nestled snugly into faith. "No, I take that back," she said, speaking as slowly as Curly ever had, "it's not gorgeous. It's beyond that. It's awesome. Curly —" she raised her tear-smeared eyes to the camera. "—when we get back, this goes to the Galactic Museum. They'll need it."

"Sure, Marj. I'll remind you."

"Before we leave, find out what you can about that Shango—they'll want to know."

"I'm afraid," it said, and its words came out at such great intervals that it might have been searching its memory banks for any other possible combination, "that it's too late. The *Deathpeace* shot the Shango. All I saw was a huge flare of light, and . . ."

The ship-puter trailed off because its owner wasn't listening. She was too lost in grief.

\* \* \*

One more time, *Deathpeace* re-ran its personal tapes of what the monitors must have recorded. (In counterpoint flowed the psi tapes, which were its alone.) The Terran ship was clearly outside the border, though only 4.98 meters. (God I hope this works my stomach's a mess.) Streaking towards it

was a silver sail, square, metallic, yet somehow billowing. (Ride the wind yet beware a flare.) 1414 kilometers away from the *Curlicue* the Shango edged to its left (Now! and release!), its rear darkened, and a wall of light slowed it. But it was still headed for the boundary (brighter my face, blacker my back, synchronize), moving as if out of control, apparently about to carom out of the system like a housefly bumbling out of a bottle (NOW! and flinch not from diversion):

Deathpeace scanned each nanosecond of memory with utmost care, searching for any telltale glimmer between the ship and the sculptor, but no, nothing showed, not on any of the screens, not even when the Philanthrope touched the border (the fear must stay down!)—flicked through half a dozen colors, a sure sign of exhaustion—and 20, 30, 45 meters of the left side of its sail swept sloppily across it, and its ocular axis— (Will it—Please, God—)

That was the signal, there—the contract said no penetration, in or out—and the sculptor had broken the law, no doubt about it.

Deathpeace reacted as it should have (NO!). Every one of its own sensors—far more acute than the monitors—showed a blinding flash of light, a veritable mini-nova out there in cometland . . . and when they cleared, they saw only the Terran, plunging away as though fearful of becoming the next victim (My God, he did it!).

*Well, if that is what my own instruments show, then the Supreme Shango is never going to know the truth.*

While it installed a new pair of infra-red receivers, it pondered what it had actually done: widened

the focus of every laser just enough so that it wouldn't cut, wouldn't burn, but would reflect . . . slammed the sailing sculptor with 200 megawatts of harmless broad-band radiation, half of which whipped back to confound the sensors, the other half of which knocked the hapless antenna-maker a good part of the way home. (Terrans played a similar game with balls and a long stick.) And then, for effect, it had blasted a 20 kilogram nodule of ore that had been entering the system two hundred thousand kilometers away. The monitors hadn't observed enough of its trajectory to realize that it would soon collide with the sculptor . . . but then, the monitors thought the Philanthrope was dead.

As it would have been—should have been—if Deathpeace hadn't been, for less than a nanosecond, one-third of a triune mind. The trinity had voted for life, 3-0.

And now the warship couldn't understand why.

\* \* \*

By the time Philanthrope regained consciousness, it was huddled into a ball, and at least ten million kilometers closer to the sun. For a while it floated, bobbing along its complex vector, far removed from all that mattered, sheathed in shock. It was hesitant to test its neurons for fear they were damaged beyond repair, but after a cycle that swarmed with thoughts that became dreams that became sketches, it extruded a tendril. Though its organs groaned, the pseudopod seemed unblemished. Cautiously, it began to spread—stiff here, sore there—until it had regained its sail-shape.



An indigested mass of metal bloated its belly; the chargecells were fat with energy. Bemusedly, it began to break down the ore and regenerate itself, searching through the molecules for thoughtprints left by distant ancestors, finding one or two and storing them despite their crudeness; 13A could, after all, decide to be an archeologist.

So the *Deathpeace* had let it live . . . odd, very odd . . . it also left the transaction unbalanced: the Terran had benefited from it, as had it itself, but what had the deathship gained? Nothing, really. It deserved *something*, though, A souvenir, perhaps, to reinforce whatever mental evolution had occurred to cause it to strike with its claws retracted . . .

Well, Philanthrope had an idea for a nice little piece, and with the extra ore and energy . . .

While the statue began to gestate, it turned its back on the sun and headed outwards.

\* \* \*

Featherstone swung through the airlock in morose silence; she stowed her suit without a word; she crouched on the edge of the acceleration couch and buried her face in her hands. She was never to learn that her benefactor had survived.

"The antenna tests out perfectly, Marj." Curly waited for a reply. Receiving none, it ventured to intrude on her privacy: "Marj? You okay?"

She lifted her head. Her blue eyes were dry and steady. Her voice was husky, but firm. "I'm fine."

"Shall we go?"

"Yes." A quick shudder. Even at that distance, the *Deathpeace* remained a palpable presence.

"It's thirteen ship days to the exit point at Procy VI."

"We're not going there—we're going home."

"Crazy Rock?" While it paused, an oscillating hum tickled the speakers. "You're the boss, so I've just swapped programs. But could you tell me why?"

She swung her legs onto the couch and lay back, her eyes fixed on the bulkhead before her. "Partly the Shango . . . it could have refused to help us—and saved its life—but it didn't; it disregarded the danger to give us what we needed. And not only that, but it put . . . it poured everything it had into that antenna. It was an *artist*, dammit; it infused that thing with beauty and meaning and . . . it didn't have to, but it was true to what it believed in . . . so was the *Deathpeace*, in a totally different way . . . I mean, I got the feeling that those two *liked* each other, but the *Deathpeace* had its contracts, its duty, and so . . . I don't know, Curly, it's like they've set me one helluvan example, and, uh . . . I guess they showed me that if you believe it, you sort of have to live it, huh?"

"If you say so, Marj. Entering 4-space."

\* \* \*

The Terran was a week gone; the Shango had just left. After replacing four chips in the Colleague Protection Circuit, Deathpeace soared through dust-spackled silence, free at last to think without interruption. One hundred kilometers ahead of it, fixed in place by its G-beams, floated a gift from the sculptor, a tangle of twisted cylinders wrought from the nodule. Sparse rays from the distant sun

pattered against it, now here, now there. There was motion in its shape, and promise, too—both contrasting sharply with the dead space it embraced. Its symbolism appeared somehow relevant, somehow suggestive of an age-old balance that was—perhaps—tilting slightly to the light.

What was it: reward? explanation? inducement?

Obviously it would require years of contemplation, and perhaps greater intimacy with another Terran . . .

\* \* \*

Homeward fell Philanthrope, pattern after pattern crystallizing in its mind. Its exposure to alienness had indeed brought insight, and creativity. It had also brought obligation: its contact with the outworlders might be the last any member of its race would have for many life cycles. The sculptures it extruded would have to be beacons lighting the beyond; timeless reminders that the New is always more enriching than the Stale; bold rejections of isolation that would circle the System, cycling through billions of systems till all had tasted.

But it could do it.

Already it had germinated a theme. ●



# THE STARS ARE WAITING

by G. Harry Stine



Illustrated by Steve Fabian



Every major breakthrough  
in human thought and  
understanding has come about  
as a result of taking  
a look at the Universe  
from a new viewpoint.

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**WANTED:** A person who wants to be immortalized as the one who *really* set mankind free of Planet Earth. Financial backing sought in exchange for having a space drive named after you. Replies in confidence to the author at this magazine's address. Serious investors only.

\* \* \*

This want-ad is not—repeat, *not*—a joke.

If you think that rockets will never reach the Moon, that bumblebees can't fly, that aeroplanes will never be able to carry more than one person, that a person will die at any speed in excess of 30 miles per hour, and that it's preposterous to think about crossing the Atlantic Ocean under steam power, you are not going to think that it is possible

to build a space drive, either. So you should skip the next couple of pages or, better yet, go back to reading *The Mill On The Floss*. This is because I intend to present some data herein that is both disquieting and hopeful. It is not speculation.

The theoretical background and mathematical foundation to permit the building of a true space drive have been completed. Some crude initial experiments have been done, and the data looks promising. There have been at least two workable proof-of-principle devices built and tested. Both devices have had their further development and investigation totally stymied because people who have seen and tested them have been trying to convince scientists that the devices work or have employed scientists to investigate them.

No scientist with any professional standing in the "scientific community" dares admit the reality of anything that totally changes the concept of the universe he has been trained to accept. Nor will he admit to anything that will render useless or meaningless his professional work of twenty or thirty years, work upon which his professional standing, salary, tenure, or political position in the pecking order depends. Even when a device is out working in industry and making money, they will either ignore it as trivial or manage to shoe-horn it into their reality. However, this article is not intended as a diatribe against Science; there are some outstanding scientists who do not fit the above definitions.

Another reason the development-to-practicality of both devices has been stymied is that most people believe that we already have a fully-developed device capable of producing motion in space: the rocket. The early space pioneers settled

on the rocket-reaction principle as the means to travel beyond the atmosphere because it was the *only known method*. Today, the rocket motor has been developed to a surprisingly high level of performance—considering that it is by its nature big, noisy, clumsy, dangerous, and inefficient—which is probably a surprising statement to come from one who is known as a “rocket engineer.”

The basic principle of the rocket is well-known and derives from a manuscript entitled *Philosophiae Naturalis Principia Mathematica*, published in English in 1687 by an astrologer named Isaac Newton. Albert Einstein, Max Planck, and others who followed built *upon* that basic Newtonian foundation as a point of departure, and shirtsleeve engineers still operate within the Newtonian universe. The rocket principle is based on Newton's Third Law of Motion: “Actioni contrariam semper et aequalem esse reactionem; sive corporum duorum actiones in se mutuo semper esse aequales et in partes contrarias dirigi,” which is to say, “Reaction is equal (in power) but opposite (in direction) to action; the actions of two bodies are equal (in power) but point in opposite directions.”

Please note carefully that this says absolutely nothing about action and reaction being simultaneous. Any engineer knows that they are not. And you can get any scientist to agree if he will admit that it is not possible to change the energy of any system in zero time.

The first scientist that probably ran head-on into the simultaneity problem was James Clerk Maxwell. He discovered that when energy was put into a system faster than the system could accept it, some of it left the system as “radiation.” However,



radiation is totally imaginary. It can be detected only by causing the radiation to create some physical change. En route from its source, it doesn't exist, and it requires a finite period of time to proceed from Point A to Point B. In the electromagnetic spectrum, this speed of propagation is called "the speed of light." Radiation can also be thought of as information conveying the message that something has changed.

What does this have to do with a space drive?

Simply that in order to even consider the possibility of a space drive, we are going to have to alter our viewpoint. Every major breakthrough in human thought and understanding has come about as a result of taking a look at the universe from a new viewpoint. The new way of looking at the universe must be accomplished under the strict caveats that (a) it cannot contradict anything that we already know to be a workable explanation of the universe, and (b) it must permit us to do things that cannot be done without this viewpoint.

Our current view of producing motion through space is based upon a simultaneous interpretation of the Third Law of Motion that requires us to expel mass at high velocity in a direction opposite to the direction in which we wish to move, thus creating an acceleration in accordance with Newton's Second Law of Motion. (Actually, it's easier to define a force with the work equation, but I will leave that to the math buffs.) It is also possible to create motion in space by transfer of momentum, permitting a mass to impact another mass.

Is it possible to create motion in space by the application of energy alone?

Renowned scientists, including some who are

avocationally good science-fiction writers and thus possess more than the usual modicum of imagination, have made the solemn pronouncement that it is impossible . . . and quite recently, too. I'll not dwell on this. Refer to Arthur C. Clarke's "Profiles of the Future."

There is very good reason to believe in 1979 that it may well be possible to produce motion of an object in free space without the expulsion of matter or momentum transfer. After all, the electric induction motor has been doing essentially the same thing since Henry invented it in 1831. Incidentally, this does not refer to the O'Neill "mass driver" which is the old electric catapult concept of science-fiction and which is, basically, a rocket reaction device with extremely low specific impulse.

A device capable of producing motion in space without the expulsion of mass would be orders-of-magnitude more efficient than the modern rocket-propelled vehicle that *throws away* more than 90% of its initial mass crawling up from Earth's surface to low-Earth orbit. (N.B.: I am *not* suggesting that we should throw away the rocket vehicle . . . yet. Don't burn your bridges before you cross them. When you've got something that works, no matter how poorly, do not throw it away until you have replaced it with something that works better. But don't stop looking for something better.)

How might we go about producing motion in space with the expenditure of energy alone?

Simple . . . but not easy to accomplish. Basically, you can do anything you want provided you do it quickly enough and thereafter either leave the system or change the system so that it cannot react.

"Come on, now! Don't give me the old story about the Rope Trick! You know what I mean: Throw a rope into the air and climb up it before it has the chance to fall down again. Then, before you have the chance to fall down, throw the rope up again . . . That won't work!"

(It would if you were on a low-gravity planetoid . . . or here on Earth if you could do it fast enough!)

If you are willing to accept the premise that the energy of a system cannot be changed in zero time, one of the consequences is that action and reaction are not and cannot be simultaneous. I. Newton was precisely correct after all. Go back and read the Third Law again; does it say anything about simultaneity?

I know of two devices that may be non-simultaneous reaction machines that apparently operate on this approach. (Let's just call them "space drives" for simplicity because that terminology does not contain highly negative words that would otherwise cause emotional problems . . . although the term may be a misnomer because the greatest immediate utility for such devices would be in mundane tasks here on Earth.) I have witnessed the demonstration of one of these devices. William E. Haynes, a graduate engineer with a solid technical background and 27 years in the USAF, has witnessed the other. As a result of my own personal experiences, I have participated in discussions and mathematical investigations of several hypotheses that would permit the reality of a space drive.

I fully realize that mathematics will provide one only with the logical consequences of one's initial assumptions . . . and that it is very easy to paint yourself into a corner. But these discussions have

been in company with several highly respectable scientists and thinkers who were not only experts in their respective fields but officers of some of the most prestigious scientific organizations in the world. I am also one of several edisonian tinkerers who have built, operated, and made measurements on experimental devices to test some of these hypotheses. The experiments were witnessed by respectable scientists and technicians, have been carried out by others with repeatable results, and have produced data that is encouraging but not conclusive.

Most of this happened to me between 1960 and 1965, when I was Assistant Director of Research, working for Dr. William O. Davis at Huyck Corporation in New York and Connecticut. It was our job to look for new and exotic things for the company to do so that it would still be in business in the year 2010. At the suggestion of John W. Campbell, the late editor of ANALOG magazine, Davis and I visited Norman L. Dean in his apartment in Washington, D.C. on September 28, 1960. Dean had reportedly developed a space drive and had been issued U.S. Patent #2,886,976 on the device. Both Davis and I studied the patent thoroughly before the visit and were extremely skeptical that Dean's device could perform as described.

Both Davis and I witnessed a demonstration of the Dean Drive together. I still have our notes made within days of the visit. These notes describe what we saw, heard, and felt in detail. During several hours with Dean during which Dean readily conducted several impromptu demonstrations that we suggested to him at the time, Davis and I both changed our minds. After we left Dean's apartment, both of us agreed that we had witnessed a real

anomaly and that the possibility of fraud or hoax was so slim as to be nonexistent. We subsequently studied the reports of witnesses to other demonstrations; these reports confirmed our own observations.

I might add that neither Davis nor myself were gullible "space cadets" — during the five years I was with Davis, we interviewed hundreds of inventors and saw dozens of wild and wonderful (and unworkable;) devices of all types.

The controversial Dean Drive is a mechanical device that produces a thrust force with no apparent reaction force and no ejection of mass. I saw the device that rested on a smooth, level, waxed floor. When not in operation, it was possible to move the device easily around on the floor with one finger, although it weighed several pounds. There was no apparent "stick-slip" frictional phenomenon involved. When operating, the Dean Drive pushed a mass approximately three times its own weight away from it with a rod . . . and did not move in the opposite direction. I felt the rod from the Dean Drive push against my own right palm; the harder I pushed, the harder it pushed back. And I was not able to move the Dean Drive in a direction opposite to that it was pushing my palm . . . except when the unit was not operating.

No person, not a Nobel laureate in physics, can ever convince me that what I saw and felt that morning was a fraud, a hoax, or an impossibility. And occurrences since that time have done nothing to alter my evaluation. I do not "believe" in space drives because of faith or a wish that they be reality. I witnessed an experiment as simple and

straight forward as any in a high school physics lab. If I am to believe all the many experiments that I witnessed or conducted in the process of obtaining a degree in physics, I must also accept the results of the experiment and demonstration that I witnessed on September 28, 1960.

During the next four and a half years, Davis conducted a low-priority theoretical research program at Huyck in the development of what Robert A. Heinlein has called "Davis Mechanics." Davis felt that he had to develop a hypothesis that would permit the anomaly of the Dean Drive to exist in the universe that we already knew.

We tried to acquire the Dean patent rights or at least to work closely with the man, but this proved to be impossible. The kindest thing that I can say about Norman L. Dean is that he was irascible. I would have liked to have worked with him because I have some questions that only he could have answered. Too late; Norman L. Dean is gone. But I was not the only person to have trouble in trying to deal with Dean. Jerry Pournelle was at that time with Boeing, and his accounts of his dealings with Dean are quite similar to mine.

However, Davis made considerable progress with his theoretical work, and I conducted several experiments whose results tended to confirm some elements of Davis Mechanics.

The basic hypothesis of Davis Mechanics is that the energy of any system can be changed only during a finite interval of time. For every system, there is a "critical action time" during which the system cannot respond as a whole to a change in energy. This is not only the basis for quantum mechanics but also provides a rationale for conven-

iently handling the starting transient or systems that appear to be operating continually in a transient mode. It is also compatible with Maxwell's work. Since Davis Mechanics is based on non-simultaneity, it offers no contradictions to relativistic physics. I'll not bore you with the mathematical details. The work has been done and is available to anyone who wishes to study it. "The simple proof is left to the student as an exercise."

A logical consequence to Davis Mechanics is the implication that any real body cannot respond simultaneously throughout its volume to an applied force. This is not only true for physical systems, but for social systems as well. In Freshman Physics 101, everybody is introduced to Newton's Second Law of Motion which is simplified to the equation  $F=ma$ . (Sorry; it's the only time that I will subject you to an equation herein.) But that isn't the whole story of the Second Law. It describes a force proportional to acceleration, a change of velocity, or a rate of change of position which changes. There is also a force proportional to position, which is called Hooke's Law and is demonstrated by a spring. And there is a force proportional to velocity, which is the viscous drag force best illustrated by the use of a parachute.

Suppose there were an additional force element beyond those of position, velocity, and acceleration—a force element that Newton could not measure and was not concerned with because he based his work primarily on astronomical observation. Newton could not have detected the additional force element proposed by Davis Mechanics: a force proportional to the rate-of-change of acceleration that is sometimes called surge, impulse, or

jerk.

Engineers have long known that this additional force element is present in systems, although they have not developed a hypothesis or rationale to explain it. It is the starting transient. It is the shock wave. It is the empirical Finagle Factor that is inserted into the equations of motion for a bowl of jello to account for the observed fact that the jello wiggles, shakes, oscillates, and deforms for a finite period of time between the instant a force is applied to one side of it and the moment it begins to behave as a Newtonian body. It is involved in strain-rate phenomena in which stress is *not* proportional to strain.

Some reader is certain to mutter something about "continuum mechanics." Maybe we are indeed talking the same language in which this is all accounted for by continuum mechanics. If so, let's find out, because Davis Mechanics has thus far been found to be compatible with Newtonian physics, relativity, and quantum mechanics.

A very simple experiment will prove to you that there is a force proportional to the rate-of-change of acceleration. Find a block of wood weighing about a pound—a short length of two-by-four will do, and the weight isn't critical. Put a screw eye in one end and another screw eye in the other end. Take a three-foot length of thread and cut it into three 12-inch pices. Attach one end of a piece of thread to one screw eye and the other end to a support such as a nail in the top of a wooden door jamb. Attach another piece of thread to the other screw eye and let it hang freely. Save the third piece of thread for Part Two of this experiment.

With the block hanging from the support by a



thread, grasp the bottom piece of thread that is not only hanging freely below the block but that was cut from the same spool. Exert a firm, steady pull downwards. The top thread will break.

Pick up the pieces, replace the top thread with the spare piece of thread, and re-hang the block.

This time, grasp the bottom thread firmly and, instead of giving it a steady pull, jerk it. The bottom thread will break.

You have just demonstrated that there is a force proportional to the rate-of-change of acceleration.

"Hold it! You've demonstrated the characteristic of mass called *inertia*!"

Perhaps you have demonstrated *both*! Perhaps you have demonstrated the existence of an "inertial field" that bears the same relationship to a gravitational field as a magnetic field bears to an electric field.

How can we make a space drive out of this? I can propose a general approach. However, it will be like describing the Otto Cycle internal combustion engine as a closed cylinder filled with a moveable piston connected to an eccentric shaft so that when an explosive mixture of air and a paraffin-olefin hydrocarbon is ignited therein, the piston moves back and forth and turns the eccentric shaft. This is not a complete explanation of what causes a 3000-pound horseless carriage to exceed the 55 miles-per-hour speed limit.

If Davis Mechanics is indeed a rational hypothesis (or maybe even if it is not and some other hypothesis does a better job of explaining and predicting) a space drive will be a dynamic device like the Otto Cycle internal combustion engine that will not appear to work at all and that will

*not* work unless it is running with all parts of the system tuned. A radio won't work either unless it is tuned. The space drive will be a cyclic system, but it will *not* be a mechanical system. Forget about oscillating masses, gyro wheels whirling, and other mechanical contraptions straight out of the Nineteenth Century. The critical action time of mechanical systems is very large; and just about the time the wonderful mechanical contrivance appears to begin to work, it will hit resonance or the forces involved will exceed the stress limits of the materials used. In other words, it will come apart in a spectacular fashion. As one who has witnessed, from a safe distance, several dozen hopeful mechanical space drives do exactly this, it's like the limiting Mach Number for a DC-8: one is enough.

Yes, there have been mechanical devices that did not behave this way. The Dean Drive was one of them. The gyroscopic device worked on by Eric Laithwaite and Alex Jones in Europe is another. But the problems with mechanical space drives are perhaps best presented in Russell E. Adams, Jr.'s article in the April 1978 issue of *ANALOG* wherein he evaluated several devices—the Goldschmidt Drive, the Laskowitz Drive, and the Foster Drive. Nearly all mechanical devices are too small or operate at too low a frequency. Therefore, in order to create an operable space drive, we are going to have to use Twentieth Century technology, get out of the mechanical resonance frequencies, increase frequencies, and be able to exercise precise control of the cyclic functions. This means using plasmas, ions, and electromagnetic fields.

Using this approach, a prototype proof-of-principle space drive might look something like a

40-watt 48-inch fluorescent light tube surrounded by suitable electric coils and magnets. The tube would generate a plasma, and Sir William Crooks would have been proud of us for discovering another use for his queer laboratory discovery of 1870.

Then we must apply a cyclic force to the ions of the plasma by means of electromagnetic fields. But this cyclic force must be one with a repetitive starting transient, so to speak. A steady sine wave force won't do it. A saw-tooth input force with a very sharply rising front edge will produce a very high rate-of-change during one portion of the cycle, while the remainder of the saw-tooth cyclic input has a lower rate-of-change in the opposite direction. The system will have to be tuned so that the leading edge of the saw-tooth smacks the plasma faster than the plasma can react. By the time the plasma reacts, the saw-tooth input is doing something else to the system with a low rate-of-change. The system may, in effect, come apart during one portion of the cycle and be reassembled during the remainder of the cycle.

This must all be done at megahertz frequencies, and controls must be provided to tune and phase the system.

I do not know whether or not the very simplified explanation of a hypothetical space drive system properly describes a workable system. It has been derived from Davis Mechanics which indicates that it might work. It deserves a try because it is a different approach to the basic principles of the Dean Drive and the Laithwaite-Jones device, both of which served as proof-of-principle devices.

The Huyck work on Davis Mechanics came to a

halt in April 1965 because the corporation decided that there was no immediate prospect of turning it into a product that would make a profit by 1970 . . . although we had already applied the principles of Davis Mechanics successfully to problems of high-speed paper making machinery in which Huyck products were involved. Davis became disenchanted either because of the outright dismemberment of a five-year corporate research effort on all projects or because he had to devote his full efforts to supporting a family. Davis went to work for NOAA in Washington, D.C. On February 19, 1973, the last time I saw him before his death, he remarked that he really would have liked to be able to continue the work because he could not shake the hunch, if you will, that there was really something to it.

Why haven't I done something about it, since the same intellectual dissatisfaction gnaws at me, too? Why didn't I continue the research? In talking with other people who have been involved or interested in space drives, I find that there is a universal feeling of utter frustration. All are exceedingly reluctant to appear as the usual sort of individual inventor who has an "anti-gravity machine" or a "reactionless drive." This league of space drive inventors does not enjoy a reputation of respectability, honesty, or sanity. There is something else going on here that is very strange and that I cannot explain. It is best described by William E. Haynes who told me, "I have found over the years that it is totally impossible to get rational engineering talent applied to the development and testing of some of these unusual devices, and that when it rarely does occur the work proceeds down the road to limbo

where it is never completed and reports are never written."

In common with many other developments in technology, perhaps the prior work on space drives has been twenty to thirty years ahead of time. When the interest in the Dean Drive surfaced and when Davis began work on Davis Mechanics in 1960, the United States had committed to a space race with the Soviet Union based upon the development of the technology then in hand: rocket technology. Who was really going to take a serious look at a non-rocket space drive when multi-million-dollar contracts were available for working on rockets? Who was interested when the real need was for rocket technology for ICBM's and for beating the Soviets to the Moon?

Now, we have a need for a space drive. To paraphrase Mark Twain, it is steam engine time. We need less expensive space transportation—less expensive by an order of magnitude or more. It is not economical to pay \$300 per pound of payload lifted into near-earth orbit; it is not even really economical at the rate of \$50 per pound for a Quick Getaway Special on the Space Shuttle. There are undoubtedly many things that could be made in space that cannot be made on Earth, or that can be made better in space than on Earth. But when the Earth product now costs less than \$1 per pound out the back door of the factory, who can possibly think of doing it in space? In the next twenty-five years, we want to do things in space to solve problems here on Earth, problems that cannot be satisfactorily solved *unless* we can get into space cheaply and efficiently. We want to build solar power satellites to provide most of our energy

needs on Earth so that we do not consume non-renewable coal, natural gas, and petroleum at a rate that may exhaust supplies within the next century. We need to build and use huge communications satellites. We want to search and mine the Moon, the planetoids, and the Jovian satellites for raw materials. We want to do things in space in a big way.

The need for a space drive is now plainly evident, and it is an economic need.

A few very simple and relatively inexpensive experiments will tell us whether or not we do indeed have within our grasp the principles that will permit the development of new devices for space propulsion. The space drive will not only open up the Solar System and thus help us solve many of today's Earth problems, but the space drive may also serve here on Earth alongside the helicopter, the VTOL airplane, the crane, the elevator, the fork lift, and other devices used to lift and carry loads.

If this is truly an identified need, where do we stand with respect to being able to fulfil such a need? What is necessary to be done?

We have what *may* be the hypothetical foundations for a space drive in Davis Mechanics. We have the mathematical tools that will help us design and build it, if it is possible at all. Davis Mechanics is at a point similar to that occupied by electricity just before Westinghouse and Steinmetz introduced alternating-current technology and theory. Where aviation stood before the brothers Wright began to work. Where wireless radio stood before the Italian nobleman Marconi committed his fortune to its development. Where the automotive industry stood on May 8, 1879, a moment one hundred years ago when George B. Selden made his pioneer pat-

ent application for an automobile.

We have the results of some experimentation that appear promising and encouraging. We can and should repeat these experiments to confirm the data with better measurements that will point the way to operational prototypes.

There are several proof-of-principle devices in existence. They deserve some further study and analysis. They deserve to be honestly and objectively tested and evaluated by several independent groups.

We know how to make definitive tests on space drives so that there can be no doubts concerning the meaning of the results.

There are people available who are eager to work in the field and not afraid of doing so, win or lose. They are intellectually honest, competent, and fascinated by the potential. They are equally ready to dismiss a hypothesis if proven wrong or to discard a device if it doesn't work. It is unfortunate, to some extent, that many of these people are fascinated by the universe and not by money; therefore, they are naïve, inexperienced, or reluctant to obtain what they believe to be an exorbitant sum of high-risk capital. Much of this reluctance stems from the fact that they do not wish to look foolish because, in the past, many financial backers have sought the independent advice of "a distinguished but elderly scientist" such as described in Clarke's Law who, when asked if a space drive is possible, will say no.

Therefore, what is needed at the moment is precisely what was described in the "want ad" that prefaced this article. The need is for a person or organization willing to risk supplying small increments of capital at various progressive reporting

points in a very high risk technical development program.

There is a chance that nothing will come of it except the sure and certain knowledge that we *can't* build a space drive, a device that will impart motion in space without using mass. If this is the case, we then know that we *must* do it with rockets after all . . . and we will bite the bullet and make the rocket device meet the requirements. If we can't build space drives, the knowledge will free an enormous amount of individual inventive brain power to work on other crazy, far-out inventions that might succeed instead. If the financial support results in a total failure to develop a space drive, the backer is at least assured of a tax write-off.

But, if the history of science and technology is any harbinger, the chances are better that there will be success. And the name of the financial backer, by agreement, goes on the space drive so that, for a thousand years or more to come, generations yet unborn will be forever reminded who provided the absolutely essential and critical element that enabled the human race to expand outward to the stars.

What will it cost?

In 1979 dollars, not very much *unless* you do the work in an established research organization that has a lot of overhead, bricks and mortar in place, lots of fancy instruments that may not be needed, and an established staff on salary. Said research organization may not want to upset any of its other clients by letting it be known that they are working on a space drive, or the space drive work may have a lower priority than applied research or product development with a lower risk factor. No, this work must be done by establishing a small organization



with nothing to lose and everything to gain, located in temporary quarters and organized frugally so that the whole operation can be dismembered within weeks if it doesn't pan out. Do it that way, and it will cost about \$50,000 the first year and \$100,000 in the next two years. It's going to be two or three people to start with, one or two of them on a temporary basis. The purpose will be to review the theoretical work, to re-do some of the basic experiments with better equipment, and to determine whether or not things are tracking. After that, the ante goes up as prototypes are designed, built, tested, evaluated, and improved. There are numerous go-no-go decision points along the way. If everything works out well, within ten years for less than a megabuck investment you've got a space drive with your name on it *and all the patent rights*, which will amount to the key to the Solar System. If it doesn't work out, you lose anywhere from \$50,000 or so up to that megabuck figure, but you have a nifty tax write-off.

As for additional details including work-flow diagrams, cash-flow requirements, facilities requirements, instrumentation requirements, etc. that are part and parcel of setting up an Edisonian research and development operation geared toward the single goal of finding out whether or not it is possible to do or make a specific end item; this is not the place for it. That's just organizational and administrative procedure. Anybody who has had to establish a small research and development operation knows how to do that. What's important is what is done, how it is done, and who does it once all the money and hardware are available.

The work requires someone who can creatively

handle partial differential equations, tensors, field theory, and statistical management of experimental data. It requires a creative electron-pushing type of person. It requires somebody who will act as a housekeeper to pay the bills and permit the creative people involved to be creative without having to hassle everyday administrative activities that they both detest and are generally incompetent to handle. No bricks and mortar with a fancy sign out front; put the operation in a rented building such as a surplus World War II barracks or other structure of such a type that the landlord doesn't care what you do to it as long as you don't totally destroy it. Acquire and pay for a couple of good, open-minded scientists or engineers as consultants to come in at irregular intervals, answer questions, ask embarrassing questions, and keep the troops honest. And get a cracking good patent attorney on retainer at once.

This may sound insanely inexpensive and atrociously simple. After all, today it takes millions of dollars, doesn't it? And teams of researchers? And a couple of Ph.D.'s to lend credence to the operation? Sorry, but American research and development has gotten spoiled rotten. If you want a space drive which is going to depend on a new way of looking at what is already there, it can almost be started in the classic American entrepreneurial manner: In somebody's garage.

A great many people seem to forget the fact that the majority of things they have around them at this moment were only ideas in "the lonely mind of a man" as recently as twenty years ago and were introduced to the market after they had been produced in a 1500-square-foot light-industrial build-

ing rented with funds derived from personal savings, private stock sales to perhaps ten investors — and every penny that could possibly be borrowed.

It may also seem totally incongruous to think that a space drive, if such a thing is possible, could come from such an environment when one sees what is required today to build and launch a rocket-propelled space vehicle. Yet in my own lifetime I have seen solid propellant rocket motors made by hand on a small arbor press in the basement of a shoe salesman in Nebraska; it's now a multi-million-dollar-per-year business. And I know of men who watched John Shesta and Lovell Lawrence make the first liquid rocket motors of the American Rocket Society on an old Sears lathe in a basement in Hoboken.

The stage is set. The props are in place. The lights are gelled and pointed. The players are ready. And the curtain can go up on the space-drive era at any moment. The need is now there. The foundations have been laid.

The editor asked me to write this article. I didn't propose it; he commissioned it.

But this doesn't mean that I am not serious.

If you are interested in the possibility of having a space drive named after you, please respond to the Want Ad that begins this article.

The stars are waiting. ●

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# FEATHERED PIGS

Another in a series  
of exceedingly short  
FABLES AND FAIRYTALES  
OF THE FUTURE

by  
FRANK HERBERT



When Bridik was four hundred and twenty-two years old and expecting to moult the next season, she decided to edit an old riddle for her companions. Bridik and her companions were long-lived and feathered pigs playing out an idyll among the oak groves of post-ancient Terra.

"It is recorded in our history," Bridik said, "that our ancestors served Man and, as reward, Man gave us these lovely black and beige feathers. Who can tell me why Man chose these colors?"

"Aww, Mom! Nobody likes to play that old game anymore," cried Kirid, her eleventh son. "We'd rather twang the lute and bamboozle."

"Come, come," said Bridik. "I am about to moult and it is my right to edit the old riddle."

"Ohhh, all right," said Kirid (who was really a dutiful son and not like some we could mention). "Who goes first?"

"That is the place of Lobrok, your father," she said, "but I don't want to hear him say the colors represent the oak tree alive and the oak tree burned."

"The kid's right," said Lobrok. "It's a bore." Then, noting Bridik's angry glare and her exposed tusks, he said: "But I'll play because it pleases you."

"Okay, Pop," Kirid said. "What's the beedeebeedee answer?"

"Man chose the colors because they represent day and night, the grass of autumn and the ashes of the past."

"Verry poetic, Pop!" said Kirid.

"May I go next? Me next?" cried Inishbeby, a fair young thing of hardly one hundred who was making a big play for Kirid.

"Very well," said Bridik. "You may play in the guest spot."

"Now, don't tell me," said Inishbeby. "Let me guess." She wangled a bamboozly glance at Kirid, then: "Black is for charcoal and beige is for the parchment upon which Man drew with his charcoal."

"That's worse than stupid," growled Lobrok. "A lot of us believe Man made parchment from pigskins!"

"I didn't know!" cried Inishbeby. "It doesn't say that at the museum of Man."

"You've spoiled the riddle," wailed Bridik. "Now I won't be able to edit it before I moult."

"Come on, Beby," said Kirid. "I think we better blow until things cool off here."

"Ohhh, where are you going to take me?" asked Inishbeby, nuzzling up against Kirid.

"Well . . . let's go snoot out some truffles and have a picnic."





# THE L-5 REVIEW #2

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The Editors of L-5 NEWS

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What we need is  
a really cheap route  
to nonterrestrial resources:  
BREAK THROUGH!



Dear Friend:

If SF is simply fun and/or money to you, skip this. But if you believe as I do that our race can and will and must spread out into space, stick around.

L-5 Society's sole purpose is to place a colony at Lagrange Point #5, the one trailing the Moon at 60°.

Sounds silly? It does to us, too, on gloomy days. We are about as far along as Willy Ley and Von Braun and Goddard were in the '30s . . . but one generation later Neil Armstrong stepped down on Luna.

And things move faster today. Technology doubles every seven years. We could build that city in space today ... but we'll be able to build it faster, easier, more economically in the '90s. Or (I'm an optimist!) in the '80s. I have already lived from horse & buggy to space shuttle; I cannot believe that human progress will come to a sudden stop. Space will be colonized.

Space will be colonized . . . although possibly not by us. If we lost our nerve, there are plenty of other people on this planet. The construction crews may speak Chinese or Russian -- Swahili or Portuguese. It does not take "good old American know-how" to build a city in space. The laws of physics work just as well for others as they do for us.

I don't think we've lost our nerve. We can put a construction crew of our own up there . . . and space is big enough for everyone -- all races, all languages. We need never be crowded again.

Dues are \$20/year (\$15 for students) and include the monthly magazine L-5 News with all the latest space news, data not in newspapers and must be dug out from technical journals and specialized sources -- our editors do it for you. The Society supplies other services, too, but I'm not going to list them, as the L-5 Society was not organized to serve or amuse its members.

ITS SOLE PURPOSE IS TO FOUND THE FIRST COLONY IN SPACE!

How's your nerve? Are your eyes on the stars? Send in your dues and join us.

Welcome aboard!



Robert A. Heinlein  
for the  
Membership Committee

## *NEWS BRIEFS*

### *Soyuz 33 Mission Fails*

The Soyuz 33 craft launched April 10 failed to dock with the Soviet Salyut 6 space station. Russian pilot Nikolay Rukashnikov, 46, and Bulgarian co-pilot Georgi Ivanov, 48, reported a system failure in the maneuvering engine at approach. They made an emergency nighttime landing 48 hours later, thanks to their Oms backup engine.

A total of 10 out of the 27 Soyuz docking missions have failed. However, observers point out that this simply reflects a Soviet design philosophy that accepts high failure rates. The Soyuz 33 failure, while disappointing, is not a setback for the Soviet space program.

### *Lunar Resources Study Completed*

NASA's recently completed Lunar Resources Study concluded that the use of lunar resources for power satellite construction probably will become cost effective if more than 3 five gigawatt plants are built. Taking uncertainty factors into account, they calculated a 92% probability that lunar resources would become cost effective for a program of 30 power satellites.

The lunar resources scenario studied would require a 36 person space base in low Earth orbit, 1,365 people in a space manufacturing complex, probably in a higher orbit, and 48 working on the Moon.

### *OTRAG Expelled from Zaire*

OTRAG, the private West German rocket firm, has been expelled from its Zaire launch facilities. The expulsion followed Soviet charges in an African

broadcast that OTRAG had launched missiles with chemical warheads with the collusion of the U.S. Central Intelligence Agency and West Germany. The Soviets also accused OTRAG of signing an agreement with the South African Republic to provide them an air base. The Soviets hinted that the Zaire test range would become the site of South African A-bomb tests.

OTRAG's recent request for United Nations monitoring of its Zaire facility came too little, too late.

### *DOE Moves Powersats to Front Burner*

Back in early 1978 the U.S. Department of Energy (DOE) was planning to hold solar power satellite expenditures to \$4.6 million in 1979 and pare them down to \$3.4 million in 1980. However, the dread Office of Management and Budget (OMB), those penny pinchers of the White House, recently surprised Congress with a 1980 power satellite budget of \$8 million.

Why, in spite of demands for spending cutbacks, did the White House decide to pump money into the power satellite program? DOE insiders say the answer is simple: there's real promise in the scheme.

DOE is also warming up to some of the more exotic powersat options. They are studying laser energy transmission and are considering the use of extraterrestrial resources for space manufacture of powersat components.

Of course, OMB approval of a stepped-up powersat program isn't quite the same as money already in the bank. But give the vociferous support of Representatives Don Fuqua and Ronnie Flipppo,

and Senators Adlai Stevenson, Barry Goldwater and Harrison Schmitt, it's a cinch that Congress will OK the White House call for an expanded solar power satellite program.

### *The X-3 Shuttle*

Daring entrepreneur Bob Truax is continuing development tests on his X-3 space shuttle. The first of three 24-foot-long, four-engine vehicles is about 80% complete and the components for two others are on hand.

The X-3 will take an astronaut on a 50-60 mile high flight on a suborbital trajectory.

Truax hopes to boost astronauts for a total development cost through initial flight testing of only \$800,000, with an incremental cost of only \$10,000 per mission. He plans to achieve this in part by decreasing the reliability of the system "down from 99% to a few per cent less," according to Paul Geyer, one of Truax's astronaut corps.

No, Geyer isn't too shook up about the few per cent chance of fatality riding the X-3.

\* \* \*

### *Bound For Glory*, by H. Keith Henson

"What should I do to improve my chances of going?" In the last four years, giving perhaps 100 lectures on space colonies, this is the most persistent question I have been asked.

It's a hard question because (among other obvious reasons) the answer depends on who does it. For example, were the Japanese to build space industries out of their balance of payments excesses, learning Japanese and the proper way to drink green tea might be the most important thing

you could do. If the U.S. government does it, joining one of the armed services could be a smart move (veterans preference in civil service). A private enterprise outfit with too many eager job applicants might want you to be an early stockholder. I admit to being partial to a company doing the job; it decreases the changes of job applicants (like me) having to put up with psychologists prodding us with electric shocks while we try to solve problems hunched over in the dark! The social scientist types have just too much hold on the government.

What causes space to be settled and how it is done makes a difference, too. Your expertise as a turbine blade machinist will be of little avail if solar cells turn out to be the power generation method of choice for solar power satellites (SPS). Likewise, your years of research in purifying and doping semiconductors won't help much if turbines are the way to go. Even your deep knowledge of phased array radar won't help if they bring the energy down by laser or turn it into antimatter and bring it down in a bag. If some massive breakthrough in fusion makes SPS unattractive, manufacturing planetary sunshades (to compensate for waste heat) or illuminators (to ward off an ice age) may be the requisite skills. You are just going to have to keep up on developments.

Of course, if the colonization of space takes 50 years, and no longevity breakthroughs are made, about all we can do is save up to buy a retirement place in "Sun City in the Sky."

Other factors that might have an effect on your chances are hard to change. Females and minority groups probably have a better chance (provided the

current social-action plans remain in effect), but sex-change operations and allover tatoos are not recommended. Lots of money is another way. With enough money you can build your own space colony, but please, no more bank robberies!"

"Well what can I do to improve my chances?" I hear you say. Here's my list. Add what you will, or make your own.

Education: get a solid practical knowledge of elementary physics and chemistry. You need not be an expert, but your life and the lives of those around you will depend on sound judgment of physical and chemical effects. I think that for the first few years no one, including the gardener and the cook, will go without a college-sophomore level knowledge of these subjects. If you are not up to this level, consider your local community college or a correspondence course. Anybody who can multiply three numbers together can figure the force on an airlock door.

Experience: work on the Alaskan gas pipeline, or spend a winter at McMurdo Sound in Antarctica. A tour of duty on a Polaris submarine would be ideal. Work on an offshore oil rig might suffice, or some other really isolated place. Many years ago I put in some time with a geophysics crew in the near vacuum (7 psi) of the Peruvian Andies. I found that some people like isolation, some are indifferent, and some go stark raving mad! Find out. It's embarrassing, not to mention expensive, to be shipped back. (If you don't like isolation, wait till the second or third group goes up. By then the discotheque will be open.)

\*See "Far Out Crime," *L-5 News*, Sept. 1978.



**Health:** if you smoke (tobacco that is), quit. 1) It's dangerous to your health in a space habitat. Non-smokers may ask you to smoke outside. 2) You may not live long enough to go.

Otherwise stay in good shape. Get a first aid card. Your local Red Cross offers classes for a small charge.

**Hobbies:** try mountain climbing (with ropes), or sky-diving, or hang gliding. Learn to fly a light plane, or learn scuba diving. Occupation as a miner, fire fighter, or farmer might substitute.

All of these have a tendency to maim or kill the careless (and sometimes even the careful), but they do teach the importance of doing things right. Be sure to get qualified instruction, pay attention, and be careful. There is a saying in aviation, "There are old pilots, and bold pilots, but no old, bold pilots."

**Miscellaneous skills:** learn to cook. If you don't know how to butcher a hog, help someone who does know. You never can tell when such a skill will come in handy. In the middle of the night on a recent business trip to Iowa, I came upon someone who had just run over a hog. The highway patrol told the guy who had run over the hog that he couldn't leave it there, so I cleaned it and he took it home. (I would have taken it, but even Ozark Airlines won't check a dead hog). Not only is this a useful skill, but you will improve your LLQ\*.

And if in spite of all our efforts we end up stuck on the ground while others go up, remember a) there's another ship next month, and b) until the shielding is up, the bitter wind of a solar flare can

\*That's Lazerus Long Quotient, see page 265—page 248 paperback—in *Time Enough for Love* by L-5 Director Robert A. Heinlein.

blow out their candles.

*International Satellite Industries, Inc. Launched*,  
by Carolyn Henson

"I'm the President of Skydoggle, Inc. We're gonna build solar power satellites out of soda straws. Can you folks tell us who's working on that stuff, and where we can get some money?"

"My brother's wife and I have created the C.O.S.M.O.S. Foundation. We plan to build the first space cemetery. Send your contribution today! You are encouraged to leave a generous bequest in your will."

These are only slightly fictionalized versions of the letters and phone calls the L-5 Society has received from people who range from the merely naive to the frankly larcenous. Needless to say, you would never hear of them in the *L-5 News*.

However, Christian O. Basler and the staging company concept are not strangers to those pages. (See "Do You Sincerely Want to Become Rich," *L-5 News*, Dec. '77.) So we greeted with delight the news that International Satellite Industries, Inc. (ISI) filed a registration statement on March 5, 1979 with the Securities and Exchange Commission. That means we can finally report on ISI's progress without incurring the Securities and Exchange Commission's wrath!

ISI started out as a purely academic idea. Christian O. Basler, a lawyer formerly with Western Electric, presented a paper on the staging company concept at the Industrialization of Space Conference in San Francisco in Oct. 1977. Encouraged by the response he got, Basler incorporated ISI last August and plans to be selling stock by this fall.

According to its prospectus, ISI intends nothing less than ". . . eventually to construct and sell solar power satellites . . ."

Why does ISI rush in where the big aerospace companies fear to tread? First, the "rush" may well be 20 years. Secondly, as a staging company ISI first accumulates capital by investing the money it receives from sales of its stock. Only the dividends and interest from its investments will be spent on power satellite research and development.

When the ISI feels it has enough of a handle on the task to make a profit building powersats, it will convert to an operating company. ISI will liquidate its investment portfolio and take out loans as needed and pour the money into construction.

That assumes, of course, that a myriad of pitfalls can be avoided. What if powersat electricity can't compete? If the vast amounts of money can't be raised? What if the U.S. or another government or another private company start to build solar power satellites first? The fallback position, if things look hopeless, is to liquidate ISI and distribute the assets to the stockholders. Due to the financially conservative nature of an investment company, the odds are fairly good the disappointed stockholders would get back most of what they put in.

Stock in ISI is not for those who need a dividend income. ISI has no intentions of declaring dividends until some years after it becomes an operating company.

However, the adventurous may take an interest in a section of the ISI prospectus reading ". . . the Company may give preference in its hiring of space workers to holders of the Company's Common Stock."

The address of ISI is:  
Christian O. Basler  
ISI  
250 W. 94th St.  
New York, NY 10025

*Breakthrough!* by Carolyn Henson

According to recent studies, a combination of asteroid mining and high performance solar sails may give us an early toehold on nonterrestrial resources. The price tag? It may be as low as \$100 million.

Are you tired of hearing that solar power satellites are the only project big enough to justify space colonization?

Do you worry about putting all our eggs in the power satellite basket?

What we need is a really cheap route to nonterrestrial resources. So cheap we can easily justify setting up the heavily shielded (against cosmic radiation) habitats people need to permanently live in space. So cheap that we can build space farms and stop having to import our ham sandwiches from Earth. And we want those cheap resources soon.

Until recently the fastest, least expensive scenario was the "Low Profile Road" proposed by Gerald K. O'Neill (*Aeronautics & Astronautics*, March 1978, pp. 24-32). The keystones of this proposal are the use of lunar resources and the "mass driver," a linear electric motor that can either be used to fling rocks off the Moon or as a reaction engine in space with its rock-throwing action providing thrust.

When these systems are all operating we will

finally have a reliable supply line for nonterrestrial resources. The cost of this "low profile" scenario? One hundred shuttle flights. The development of mass drivers, lunar landers, a high orbit passenger vehicle, a mass catcher, lunar base and mine, and a space station. The estimated price tag is just under \$10 billion. This part of the project would take 11 years.

Unfortunately, it's a long way from lunar rock to some money-making end product. O'Neill estimates a price tag of another \$9.5 billion just to break down lunar rock into its component metals, oxygen and silicon. The next step is a dilly. Fabricating raw materials into end products is expensive, as anyone who has compared the price tag per kilogram of pig iron v.s. Mercedes Benz is aware. O'Neill estimated an investment of about \$6.5 billion of research and development would set up a plant that could turn metals and silicon into power satellite parts.

This is a reasonable investment as part of a solar power satellite project. Power satellites could generate tens of billions of dollars per year of income. But no other project or group or projects on the NASA drawing boards could justify this "low profile road."

Former O'Neill research assistant K. Eric Drexler has followed another line of research. Substitute solar sails for mass drivers and asteroids for the Moon and we may get nonterrestrial resources for an investment of well under a billion dollars.

Many asteroids are actually closer, in terms of "delta-V," than the Moon. In space, distances are nearly meaningless. What's really important is the change in velocity, or delta-V, an object must un-

dergo to move from one orbit to another.

A round trip from the surface of the Earth to the Moon requires a 9 km/sec delta-V. A round trip to the asteroid 1943 Anteros needs only an 8 km/sec delta-V. A "shortcut" using a double gravitational slingshot maneuver around the Moon brings the delta-V down to 2.2 km/sec. Using the same maneuver 1977 HB Bacchus has a delta-V of 3 km/sec.

Asteroids are far richer sources of materials than the Moon. The Moon lacks hydrogen (necessary to make water), nitrogen and carbon, elements essential to life. Lunar oxygen, aluminum, titanium, and silicon are tied up in hard-to-smelt compounds such as silicates. To put it bluntly, known lunar resources are about as poor ores as ordinary Earth rocks and dirt.

However, on the basis of meteorites that have struck the Earth and asteroidal reflection spectra, we can tell that many asteroids contain rich ores. Nickel/iron asteroids such as the nearby 77 VA Amor contain huge lumps of nearly pure nickel/iron steel. And some of their "impurities" are worth looking at twice: chromium, cobalt and platinum. Carbonaceous chondritic asteroids, such as the nearby Ra-Shalom, contain water and carbon in large quantities, and significant amounts of the biologically critical nitrogen. The water can be extracted by simple distillation.

According to Eric Drexler, "Sporadic studies of solar sailing stretch back well over twenty years. For obvious reasons, nearly all serious studies have focused on launchable, deployable sails, made of necessity from comparatively rugged plastic film materials. The recent renewal of interest in solar sailing sprang from a Jet Propulsion Laboratory

design study, which showed the feasibility of deployable sails of impressive performance.<sup>1</sup>

"Space-manufactured thin-film materials promise sails with 20 to 80 times the performance of the best deployable sails; this would seem to justify a re-examination of solar sailing.

"While solar sails appear to be ideal for asteroid mining missions, they have many other potential uses. Their research-and-development price tag—possibly-as-low-as-\$100-million—could be justified by any one of the following:

- Such sails can serve as reusable interplanetary shuttles for delivery of orbiters, landers, penetration probes, etc., and can return samples from other low planetary orbits to low Earth orbits.
- Their unlimited delta-V capability allows asteroid survey missions of indefinite length.
- Their high performance permits a rendezvous mission to Halley's comet with a flight time well under a year, and permits pre-perihelion rendezvous mission, with subsequent sample return, to objects on parabolic trajectories.
- Their high performance permits not only fast out-of-the-ecliptic missions, but establishment of permanent solar polar observatories (see Figs. 6 (a) and (b)).
- With the aid of rocket stages, they can deliver large payloads into orbits around the outer planets with short mission times.
- They can perform 1.5 year flyby missions to Neptune and Pluto.
- Since they can deliver substantial payloads to solar-escape trajectories with hyperbolic excess velocities of 100 to 200 km/sec, they can

greatly speed the exploration of the heliosphere and the nearby interstellar medium. Delivery of x-ray telescopes to such trajectories would permit measurement of the distances to certain suspected black holes, after a few years flight time, based on their rapidly flickering intensities and the curvature of the oncoming x-ray pulse. In a decade or so, astrometric equipment on such trajectories could measure parallax and hence distance for any visible object in our galaxy."

However, the "big time" is retrieval of nonterrestrial resources. According to Drexler, "Historically, a great barrier to the use of nonterrestrial resources has appeared to be the high initial cost of the recovery systems. But the high performance solar sail's low-cost, deep-space transportation capability is well suited to operation without crew maintenance. With it available, the threshold to nonterrestrial resource recovery may apparently be crossed with a single shuttle payload.

"One approach to the surface mining of a small asteroid [is] based on a device which sweeps up loose surface matter and places it in a bag. Such a device may have many redundant sweeping heads, and seems unlikely to require human attention. A 200 ton sail load, appropriate to a 100 newton force sail, may be swept up in under a month at a rate of one tenth kilogram per second. A few millimeters thickness of loose surface material would suffice for many loads of this size, which may be returned with trip times on the order of a year. Two accessible asteroidal bodies with much loose material are already known: the moons of Mars. It would be ironic if they proved more attractive than our own."



The U.S. Department of Defense might develop an interest in extraterrestrial resources.

"Asteroid resource recovery systems open a range of non-solar power satellite scenarios for space development. Demand for a few hundred tons of asteroidal material for radiation shielding could justify mining operations. Military demand for asteroidal steel to harden orbital installations could easily exceed 10,000 tons (or 100,000 tons, for that matter). Mass transport rates of this order of magnitude would drop the total amortized program cost per kilogram returned into the \$2-20 range. Incremental costs for sail production would be low, and incremental costs for the use of existing sails would be almost negligible."

In the longer run, asteroid mines may sell their products to Earth surface customers. Drexler points out that "Many asteroids apparently contain a good grade of steel, with a typical cobalt content around 1% and a nickel content around 10%. Sail transportation costs from Apollo objects, at substantial traffic levels, should fall below 50¢/kilogram. This may be compared with the market prices and world demands for cobalt (about \$10/kg and 20,000 tons/year) and nickel (about \$5/kg and 700,000 tons/year). If a suitably low-cost concentration or purification process can be found, and if return of materials through the atmosphere proves as inexpensive as expected,<sup>2</sup> these metals might be sold on Earth. World markets are several billion dollars.

"A large market might also be developed for foam steel. It should be easy to produce in space, and would require little refining of the raw material. Its unique properties might bring a price of several

dollars per kilogram (roughly comparable to that of some wood products).

"Preliminary estimates of the cost of mass-produced solar sails, using nonterrestrial feedstocks and a shuttle-derived heavy lift launch vehicle for equipment transport, fall around 75¢/m<sup>2</sup>, yielding transportation costs around 6¢/kg from a suitable asteroid. Since pig iron sells for over 20¢/kg, and steel bars, plates, etc. for over 40¢/kg, a nonterrestrial steel production industry is not out of the question. U.S. demand for pig iron is presently over 70 million tons per year; worldwide demand is almost 500 million tons per year. Cheap process heat, zero gravity, and accessible vacuum all make space attractive for steel processing. Steel and cheap energy as a basis for industrial development is an old story."

## References

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## *What's Holding Up the L-5 Show?*, by Ed Bas

"The crowd had pushed to the west end of the platform as the ship swarmed up the mountain. Harriman had stayed where he was, nor had Dixon and Strong followed the crowd. The three were alone, Harriman most alone for he did not seem aware that the others were near him. He was watching the sky.

"Strong was watching him. Presently Strong barely whispered to Dixon, "Do you read the Bible?"

" 'Some.'

" 'He looks as Moses must have looked, as he gazed out over the promised land.'

"Harriman dropped his eyes from the sky and saw them. 'You guys still here?' he said. 'Come on—there's work to be done.' "

—Robert Heinlein, *The Man Who Sold the Moon*

Where are you, Delos D. Harriman, now that we need you? Our power monopolies had Edison, Ford had Ford. Who will sell space? Heinlein wrote the blueprint for him in his 1940 story—wanted: a pioneering spirit, a mover and a shaker. But where is his real-life counterpart? Who will make outer space the greatest thing since sliced bread?

For all the good intentions, there are still major stumbling blocks to the industrialization of outer space by American industry. Art Dula, a Houston corporate attorney specializing in technical and patent law, believes he has identified the "most important inhibitors affecting the potential commercial materials processors/NASA business relationship.

Yes, "inhibitors."

For the most part, he points, the finger at a general lack of knowledge on the part of the private, non-aerospace contractors of what space (read: NASA) has to offer. What's more, they don't know how to deal with the government (again, read: NASA) and are uncertain or downright uneasy over working within government constraints. And most important, Dula notes a lack of an "obvious mandate from within NASA to promote commercial materials processing."

Mandate as in "an authoritative command"—*Webster*.

NASA would like private industry to commit funds early to research and development aboard the space shuttle. But private industry is in a trend of shying away from pure R&D, and the more they demonstrate this the more reluctant NASA seems to "sell themselves."

It has to do with traditional "laissez faire" of government in industry—hands off or the next step is socialism. Or maybe, like most government agencies, NASA has a problem in selling themselves because they simply don't know how to go about it.

Dula suggests large amounts of personal contact, and willingness to involve all non-aerospace industry.

Dula also points out the risks incurred by business in outer space ventures. Take the Skylab crash, for example.

Is private industry ready to take such a risk for a launch they sponsor? And, more important, do they carry such risk?

A 1972 United Nations treaty gives clear and absolute liability to the launching state in the event of an accident. This is the Liability Convention, a sort of corollary to the 1967 Treaty of Principles.

If there were a question of liability, what would stop the United States from financing a catch-all umbrella insurance policy, such as it did with the nuclear power industry in the Price-Anderson act?

There is also some confusion over whether patent and data rights can be retained by non-aerospace users of the shuttle. No one industry is going to bridge new frontiers if it can't be sure of hanging onto new knowledge. Dula says that this goes back to the Kennedy era of "full light of disclosure" to contrast the Soviet Union's secret space

program. And Dula calls the policy "an open invitation to a third party suit seeking to force NASA to disclose publicly the results of research done on the space transportation system by non-aerospace industrial users."

NASA could remedy this easily and immediately, by waiving any requirements that industry information be made public.

Looking beyond the shuttle, who owns the Moon? A 1971 International Lunar Treaty states that "the surface and depth of the Moon cannot be the property of states . . . or not as well as the property of physical persons."

Could international space law prevent the movement of lunar materials once a mass-driver is established? Do we have the right to go in and kick things around before Zambia and Botswana can build rockets and have the thrill of a national "first" Moon landing?

Can a government entity ever successfully interact with American industry? Or are the two forever distinctly separate breeds?

Is American industry really settling into complacency, afraid of speculation? Are we sure how liability, patent laws and government contracts will fare in the future? For every step, there seems to be another question left unanswered, to say nothing of those that haven't been asked yet. But making money isn't supposed to be easy, or without commitment, or risk.

As D. D. Harriman said, "You ask me to show figures on a brand-new type of enterprise, knowing I can't. It's like asking the Wright brothers at Kitty Hawk to estimate how much money Curtiss-Wright Corporation would someday make out of building airplanes."

*High Frontier Politics* by Ken McCormick

There are several widely-held ideas on the politics of space which I believe are rooted in misconception. The worst misconception that I have encountered (and encountered frequently) is that a solar power satellite (SPS) construction program as described by Gerald K. O'Neill would not be important to the early achievement of a large-scale use of nonterrestrial resources and space settlement. This belief is often held by those who complain that SPS is a shaky and unpopular proposition and should be ignored by high frontier enthusiasts. Since it is well-agreed-upon that no one is likely for purely spiritual reasons to provide the billions of dollars needed to build space colonies, anti-SPS space colony buffs look to other areas of space industrialization to provide the economic incentive for investment in large space habitats.

What is wrong with this belief is that no other project on the horizon even comes close to offering the spur to space colonization that SPS offers. Science Applications, Inc.'s study of space industrialization opportunities, published April 15, 1978, provides some indication of the relative importance of SPS to other now-anticipated space manufacturing projects. SAI estimated the cumulative revenues which might accrue by the year 2010 from the space manufacture of pharmaceuticals, semiconductors, fiber optics, special metals and other products, and came up with a total of 64 billion dollars. Using the same general assumptions, they also estimated the cumulative revenues from an SPS project over the same period at 200 to 600 billion dollars. Dr. Gerald K. O'Neill believes that SPS produced according to his plan could ultimately provide all the world's new electrical

generating capacity, and therefore would be producing revenues of at least \$200 billion *per year*!

The simple comparison of revenues which can be expected to be produced by various projects is, I will admit, a very crude approach. There are other things to be considered. But the need to explore and open new frontiers, alone, will not lead to the colonization of space any more quickly than it has led to the colonization of the Antarctic continent or to the construction of cities beneath the sea.

NASA recently sought to determine what projects could be more economically accomplished using nonterrestrial resources instead of launching the necessary materials from the Earth's surface. - Only one project could be found which showed great promise. It was SPS.

I have sometimes heard the view that there is a parting of the ways shaping up between one camp of SPS proponents, led by Peter Glaser, who support the concept of ground-launched SPS, and another camp of proponents, led by Gerard O'Neill, who support the concept of SPS produced from nonterrestrial materials. The belief is often held, moreover, that a ground-launched SPS program would be destructive to any hope of achieving the goal of O'Neill's "high frontier," and that L-5'ers should therefore oppose the concept of ground-launched SPS.

This seems to me to be an example, on the amateur enthusiast level, of the "corrosive atmosphere of conflict" which was so well described in Eric Drexler's article on "The New Space Program" in the July 1978 *L-5 News*

It is true that Dr. Glaser has not been as outspoken in his support of the nonterrestrial mate-

rials (NTM) option as some of us would like him to be. He does, however, support Dr. O'Neill's plan as one of the options to be considered for the construction of the satellites. In the Senate last August Dr. Glaser testified, "The SPS development program will focus development efforts on space processing, fabrication, assembly and maintenance, human habitations in orbit, space transportation efficiency, and the possible use of extraterrestrial resources, thus setting the stage for achievements which may transcend anything that heretofore has been achieved by the human species. I believe that we are here on the verge of a new evolution—an evolution that can take us into space in ways which we have dreamed about for many years."

Both Dr. Glaser and Dr. O'Neill have told me that they will continue to cooperate closely. Dr. Glaser will contribute a chapter to a book on space industrialization now being put together by O'Neill's close associate, Dr. Brian O'Leary. Dr. Glaser and Dr. O'Neill will also collaborate on a paper on SPS for the Vienna U.N. Conference on Science and Technology for Developing Countries.

Some people point out that Congress cannot be expected to commit the nation today to O'Neill's concept of NTM utilization for space industrialization. I believe that they correctly assess the present situation, but I hope that pessimism will not silence their advocacy of the high frontier. The national mood can change. If the SPS evaluation program is favorably completed and a commercial SPS capability demonstrated, and thorough studies indicate that NTM and large space habitats could dramatically reduce the cost of SPS, Congress might then commit us to O'Neill's "high frontier." ●



# SPIDER VS. THE HAX OF SOL III BY SPIDER ROBINSON

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*Hot Sleep*, Orson Scott Card, Baronet, 309 pp., \$5.95  
(Ace, \$1.95)

*Titan*, John Varley, Berkley, 302 pp., \$9.95

*The Wanting Of Levine*, Michael Halberstam, Berkley, 458 pp., \$2.25

*Galactic Empires, Vols. I & II*, ed. Brian Aldiss, Avon, \$2.25 each

*The Shores Of Space*, Richard Matheson, Berkley, 211 pp., \$1.75

*Nightmares And Geezenstacks*, Fredric Brown, Bantam, 182 pp., \$1.75

*Kinsman*, Ben Bova, Dial/James Wade, 280 pp. \$8.95

*Universe 9*, ed. Terry Carr, Doubleday, 182 pp., \$7.95

*A House In Space*, Henry S. F. Cooper, Bantam, 183 pp., \$1.95

*The Third Industrial Revolution*, G. Harry Stine, Ace, 234 pp., \$2.25

*Bitter Disappointments,  
Pleasant Surprises,  
And Sure Things*

"Your trouble," Baen says to me, "is you're going soft."

Instantly I compiled, assessed and rejected some twenty-five witty answers, the bulk of them obscene. He'd already have thought of them all, plus a few I'd doubtless overlooked. "How do you mean?" I answered seriously.

"You've been writing review columns for me, in one magazine or another, for going on five years now, and I can't *remember* the last time you tore a book to pieces and danced on the pieces. You used to come away from a column with blood and feathers on your chin, looking for the cranberry sauce—but nowadays, dammit, you're getting soft. You *like* everything."

So I pulled the files for the last dozen columns or so, and damned if he wasn't right. Well, exaggerating slightly: I did pan *some* books in those twelve columns, sometimes emphatically. Exactly nine of them, out of more than a hundred. I got worried. Was I losing my guts, pulling punches subconsciously to avoid making enemies in the trade or something?

After a little thought, I relaxed. The problem, if problem it be, is in my selection process, and it derives from selfishness.

In the old days, you see, I read pretty much whatever came in first, and finished everything I

started. Reporting the results naturally got rather gory at times. But over the years I have come to place a higher value on my time, and the satisfaction of dancing up and down on Hax for your edification is no longer worth the time it takes to identify and study them. I rationalize this with Sturgeon's Law (90% of everything is crap), telling myself that you can *assume* any given book is shitful until proven otherwise, and that what you *really* need is someone to locate the good ones. But the truth is, I no longer want to spend precious minutes and hours reading bad books, even for a fee and considerations.

Consequently, I now pick books that look like I will enjoy them. And if I'm not having a good time twenty pages in, I abandon the book (and therefore the right to express opinions about it in print). I've been reading this stuff for over twenty-five years now, modifying my selection criteria by negative feedback, refining the selection-skill, and by now my batting average seems to be over .900.

Now, obviously a book can fall apart in its latter stages. I am pleased and astonished by how seldom that has happened in the last dozen columns—apparently, in science fiction, a book that doesn't have a strong ending tends not to get written in the first place. (This makes sense: if you convey a reader to a place he doesn't want to be, the more skillfully and irresistibly you have done so, the more he will hate you.)

But of course it does happen. No matter how good your selection process, sooner or later it will happen as often as two times out of ten—as, for instance, this month—and when it does, it becomes one of life's

Orson Scott Card is the sixth winner of the John W. Campbell Award for Best New SF Writer. It is *not* a Hugo Award, though it is voted on by the same group (anyone interested) and given out at the same convention: it is a plaque rather than a rocketship, privately sponsored by the publishers of *Analog* magazine. (Lisa Tuttle and I tied for the 1974 Campbell, so I know whereof I speak.) Therefore Card is bound to catch a lot of hell for the lines on both front and back covers of the Baronet trade paperback edition of *Hot Sleep* describing him as a "Hugo-Award Winner."

Which is a shame, because it's not Card's fault—writers seldom if ever see a cover in time to make changes (and not by accident)—but Baronet's. (The Ace paperback edition has it straight.) What *is* Card's fault at least as much as theirs is the contents of the book, and for a writer of his ability it is astonishingly bad.

Part of the problem is Sagamania, an evil closely related to the insidious Sneaqueel. This novel is part of a grand-scale future history, like the bulk of John Varley's work, and so it shares the fatal weakness of Varley's *Ophiuchi Hotline*: that you're going to have to wade through tens of thousands *more* words, some as yet unpublished, to get any coherent idea of what the hell is going on here. (This flaw is not intrinsic to the future history saga, as God knows Heinlein proved—it is simply the commonest way to do it wrong.) Worse, Card's entire future history seems to have one central keystone, and it is a dumb one. The whole saga revolves around a drug called *somec*, which gives immortality. Only it

*doesn't*. It gives suspended animation. It adds not one day of subjective time to your lifespan — merely stretches that span across centuries of objective time, ensuring that you will live out your life in permanent temporal/cultural dislocation. For some reason everyone in Card's future is desperate to obtain this wonderful stuff, and I'm *damned* if I understand why.

But that's only part of the problem. Somec aside, the book resolutely refuses to make any sense. Let's study the plot.

Opening situation: there's a mutant strain of telepathic humans, feared and hated by normal people, who call them Swipes. The mutation can *only* be inherited from the mother. Thirteen-year-old genius Jason Worthing is suspected by the Empire authorities of being a Swipe (even though his mother unquestionably is *not*), because he answered some very difficult questions on an astrodynamics exam. (This is of course suspect in a known genius.) So, to test him, the authorities give him a second exam containing questions to which the examiner does not *know* the answers—to which in fact no one on Earth knows the answers. Jason gets them right too. Aha, say the authorities, that *proves* you're a Swipe.

Huh?

As it happens, Jason *is* a Swipe, although he cannot possibly be (this never gets explained), and so naturally the police capture him without the slightest trouble. But just as they put the cuffs on him, along comes a man named Abner Doon, whom I vaguely recall from Card's previous short story collection, *Capitol*. (Only vaguely: the basic flaw in Sagamania.) Doon, it says here, is the grand-

est puppet master in history, the secret and unsuspected ruler of the universe, a Hari Seldon figure who is attempting to manipulate the destiny of the human race without anyone knowing it. The Empire police of course recognize him at once and hand over their prisoner at his verbal request. What they tell their boss I don't know.

Doon has had his eye on Jason for a long time: the boy is "special," although we never learn just how. He recruits Jason to help him save the human race. We next meet Jason a decade or two later: he is now a famous starship captain and movie star. (Good starship captains do not make good movie stars.) He becomes involved with underground plotting to overthrow the Empire. He helps Doon round up and arrest the whole underground. Doon's intention is to have Jason pilot all these rebels to a distant planet and maroon them there. This, he inexplicably believes, will somehow plant the seed of a better human race, "a branch of the human family that could know and understand what other human beings are—and love them anyway." He gives Jason no clue as to how this might be accomplished, and Jason duitfully takes off with 333 somec-drugged prisoners (some of these people he's shanghaiing are friends of Jason's).

Oddly, fate and his own incompetence almost provide Jason with a way to pull it off. At turnover, his ship is fired on by the enemy (what enemy?), and he cleverly intercepts the missile with the cargo-compartment full of passengers (to prevent it doing any damage, you see). This kills  $\frac{2}{3}$  of them, and destroys all but one of the memory-tapes of the survivors. They will emerge from somec sleep as

mindless as infants, and might indeed have a chance to build a sane culture from scratch, given some very wise guidance by Jason.

So he decants them onto the most worthless world imaginable, keeps them ignorant and primitive and poverty-stricken, gives them the modesty taboo and the concepts of jealousy and illegitimacy, and encourages them to believe he is an omniscient, omnipotent and immortal God. Using somec, he observes them every few decades, and finds to his surprise that given all the worst features of the Judeo-Christian tradition, they somehow fail to become angels. So he uses the one surviving memory-tape, and for some reason the revolutionary he revives takes the notion that Jason is a fascist and goes out to try and foment a revolution. With the tacit blessing of Jason, who after all has no better idea, this right gives the ignorant savages technology (tallow lamps seems to be the sum total), nearly destroys the colony with dissension and civil war, and then takes the best and brightest off on an insane suicide quest for heavy metals which he hasn't the tools or technology to work. Jason nods approvingly.

A few hundred years later Doon shows up unannounced, sees that everything is now fine (?), congratulates Jason on a great job, and retires. Jason gets into the starship, flies it to the bottom of a nearby ocean, and goes to sleep. End of book.

What kept me reading? Well, partly, of course, Card's reputation, the reasonable assurance that before long all this was going to begin to make sense. And by the time *that* wore off, I had reached the section chronicling the formative years of the colony, as told by the diary of one of the colonists,

and that section is some *damned* good storytelling, absorbing and engaging and promising as hell. Say, from pages 151 to 182. After that the book's plot intrudes again, and by page 259 I was so confused that I frankly finished it only because you shouldn't review a book you haven't finished and wanted to warn you. I mean, I can't guess where Card thought he was going—all I know is he didn't get anywhere.

Let me modify this heap of scorn slightly by saying that it is precisely because Card has so much skill and talent that this book disappoints me so bitterly. Right up until halfway through I believed and hoped it could be pulled together. There are some good characterizations and some interesting situations in here, the two things Card does right most consistently. But the story-logic wouldn't convince a Cattlecar Galactic-Uh fan.

I think *Titan* was a more bitter disappointment. Not because of the magnitude of the failure—it's *miles* better than *Hot Sleep*—but because of the height of the expectations with which I went in. This is one of the problems of the really terrific writer.

Not that John Varley has published more than a half dozen perfect stories, these last three or four years; often I finish a story of Herb's (his friends call him Herb, with a hard "h".) with major or minor reservations (usually minor). It's just that the good parts are invariably *so* good that I long ago made up my mind to read anything he publishes, at once.

Look, *Titan* almost succeeds, comes so close it hurts. It is a strong book in many ways, certainly more coherent and less complicated than Herb's



first novel, *The Ophiuchi Hotline*. I enjoyed myself immensely, right up until the end. Herb piles mystery on enigma on puzzle on paradox for over 200 pages, teasing you, defying you to guess the reasons for all the inexplicable happenings. And when you get to the finale, the Grand Explanation . . . I just didn't believe it. The *emotional* logic just doesn't satisfy.

Plot summary: seven astronauts expecting to study the eleven moons of Saturn find a twelfth, a wheel-shaped artifact a whopping 1300 *kilometers* in diameter.\* When they approach, it eats their ship and kidnaps them: they wake to find themselves stranded inside the vast wheel, naked, totally bald, scattered across miles of terrain, most of them mentally changed in various subtle (often horrible) ways. Asexual Gaby has become a compulsive homosexual, fixated like a baby duck on our protagonist, Captain Cirocco "Rocky" Jones (to Rocky's extreme dismay). Gene has become (it develops) a rapist. Calvin has become a misanthrope who prefers the company of aliens and April has been physically altered into a harpy-like creature, all but a trace of her human identity obliterated. Oddly, Cirocco, Bill and August seem relatively unchanged, except that each now knows and speaks fluently one of the local languages.

The big wheel is approximately equivalent to Larry Niven's Ringworld in size (subjectively speaking: I know the Ringworld was a million miles in diameter, but Larry's characters had high technology with which to cover ground, whereas Herb's have only Shank's Mare.), with "spokes" like 400-

\*Although a horrifying typo in an early chapter gives it as "1300 meters"!

kilometer chimneys and "support cables" like tubular mountains, shaggy with forest. The obvious questions are: who built it? Are they still alive? (The wheel seems to be in considerable disrepair, several cables snapped and unrepaired.) How and why were most of the seven humans altered? There are several sentient but primitive species living in the wheel (not very imaginative ones: centaurs, harpies and flying whales)—where did they come from? And why do the centaurs and harpies fight each other so bitterly and pointlessly? All the answers seem to lie up at the hub, so heroic Captain Cirocco resolves to go there, on foot, up one of those mammoth cables through a spoke, accompanied only by the hopelessly devoted Gaby (and leaving behind the man she's been sleeping with, on the perfectly reasonable grounds that he wants to go with her and therefore is probably getting all possessive and male and stuff<sup>\*</sup>).

Now, Herb does a superb job of conveying just what a stupendous undertaking this is—by the time Rocky makes it to the hub, I'm as exhausted as she is (so exhausted that both of us—and the author—forget that there should be next to no gravity here). What has sustained me this far is the brilliance of John's descriptive powers; what has sustained Cirocco is cold rage. She has been shanghaied, hijacked of her command, starved, frozen, menaced by critters, marched, humiliated and raped (not just the tampering with her mind—though that is arguably the blackest of

<sup>\*</sup>She bitterly resents the fact that he keeps "challenging her authority" by occasionally disagreeing with her opinions. She—and Herb—seem to forget that a pilot whose command has been destroyed has no authority. None of them are military personnel.

rapes—nor even Gene's insane sexual rape. Cirocco—and all the other females—were pregnant when they awoke in the wheel, with fetuses which when aborted proved to be nonhuman). Upon arrival at the hub she *demand*s an explanation.

**SPOILER WARNING! IF YOU DON'T WANT TO KNOW THE ENDING, SKIP TO THE NEXT REVIEW! SPOILER WARNING!**

And the Goddess Gaea, a centuries-old alien life-form whose body is the entire wheel, appears to her (in the form of Bella Abzug) and says essentially as follows:

"Yes, I did all that, to you and your companions. I also created those sentient beings 400 clicks below and forced them to slaughter each other mindlessly and for no reason. I also required you to walk the distance from New York to Quebec, straight up, to ask me about all this, although I could just as easily have saved you the whole trip. I did *all* these things for the same reason: it amused me. Now here's my problem: for inexplicable reasons, parts of my own immense body itself are actively rebelling against my control. That's why this wheel is in such disrepair: I have to keep threatening suicide to maintain control over my own extremities. I want to hire you as a troubleshooter, fence-mender and all-around Henry Kissinger, and you have just passed your personnel interview. I need you because while I can tailor sentient races to order, I can't seem to instill *gumption* in them, and you've got it. I make no apology for the vile and abominable things I have done to you and all the others—I am a Goddess—and the job pays nothing but the sheer fun of being able to cause earthquakes and do

magic. What do you say?"

And Captain Rocky says essentially like this:

"Say, that sounds like a grand adventure, more fun than going back to a desk job on Earth. I'll do it. By the way, don't bother changing my crew back to their original identities; they seem happy as they are. And I forgive you for making me climb that 400-click beanstalk; in retrospect it was kind of fun."

End of book, save for a brief epilog.

Now it is conceivable (in light of the news in *Locus* that this is Volume One of a series) that there is more here than meets the eye, that, say, Cirocco is taking the job only to acquire enough clout for a really satisfying vengeance (although by the last chapter a rescue ship has arrived from Earth bristling with H-bombs, and she informs them that Gaea is no threat at all and they should start setting up tourist excursions!) (And come to think of it, how did that rescue ship get inside the wheel? Tunnel through the floor and let all the air out of the tire? Orbit between whirling spokes?). Or it could be that *her* mind has been as subtly warped as some of the others and she's going to snap out of it in the sequel. But first of all, there's no internal evidence of this, no hints planted, and second of all even if it's true it's small consolation to someone who paid out \$9.95 plus tax and got an emotionally implausible finish for his money. If you tell him that another \$9.95 or two *might* ease his distress, he is liable to punch you in the nose. This is the Snequel Syndrome I spoke of earlier, and I just don't think it's what's happening here. But what *is*?

Right up until her unbelievable behavior at the denouement, Cirocco is an excellent job of charac-

terization, with the little inconsistencies and emotional problems that real people have. Other characterizations stand out, particularly two centaurs named Hornpipe and Meistersinger. And although she is more of a tropism than a person, Gaby too is vivid and memorable. I cared what happened to all of them—that's a lot of the problem.

Dammit, for the second time (out of two) I am forced to describe a John Varley novel as a very interesting failure.

Footnote: the couple dozen b&w interior illos by Freff are among the best work he's ever published—good enough that Herb tells me he's buying some of the originals. God, it's so nice when the artist can not only draw but read as well. His maps and diagrams in particular were enormously helpful in visualizing the story.).

The hell with this grisly business. Let's dump bitter disappointments and go on to:

### *Pleasant Surprises*

Publishing houses being the efficiently organized enterprises they are, most of the ones who send me review copies (about a third of the total are *that* organized) send me *everything*: nurse novels, gothics, dusters, spy-thrillers, crosswords, steaming tales of miscegenation on de ole plantation, inspiring texts on faith by Norman Vincent Peale, D.D., and other stuff too vile to even describe. I estimate that in the last year I have received something like \$1200 worth of books that I could not

possibly review even if I had an iron stomach. Oddly, Sturgeon's Law does not seem to apply here: ninety-nine percent of the mainstream books I receive are awful.

So it's an unusually pleasant surprise when one of them turns out to be not only *damned* good, but a closet science fiction novel.

How literally and emphatically do I mean those two assessments? Well, last week I nominated *The Wanting Of Levine* for a best-novel Hugo. Does that answer your question?

Set in the 1990s, *Levine* is the story of how a retired Jewish traveling salesman and confessed multiple adulterer named A. L. Levine gets elected President of the United States. By me that makes it sf (if not fantasy) and I don't care if it was a mainstream bestseller and selection of the Literary Guild (anybody's welcome in this here ghetto, but especially the ones who bring their own lunch.). It is inventive and warm and witty and wise and as funny as hell in places (especially the scene I shall always remember as "Guess What's Coming For Dinner?"—you'll know it when you see it), and I'd have to call it the most enjoyable novel I've read in many months. Levine himself is a superb and memorable job of characterization, one of the most sheerly likeable characters of my experience (he's *not* a politician—that's his secret weapon), and his escapades and experiences political and sexual are absorbing and plausible. I intend to follow author Michael Halberstam's career from now on, whether or not he ever again skirts the border of our genre.

Hell of a note when the most enjoyable sf novel in the pile is by an outsider—the surprise is not *totally* pleasant, if you see what I mean.

What with all this noise about getting soft, I decided to pick at least one book for this column that *didn't* look promising and finish it no matter what. (I had no way of knowing at that point how badly Card and Varley were going to let me down), and Brian Aldiss's *Galactic Empires* series seemed tailor-made. I knew an anthology of galactic empire stories *had* to be dumb, and it seemed logical that a two-volume set would be twice as dumb. I mean, the whole *notion* of a galactic empire is silly.

It was this same unerring instinct that once led me to turn down Xerox at a dime a share. Volume One turned out so well that I located and read Volume Two at once, and it was even better. Apparently there is no subgenre of sf so silly that it has not been worked for grocery money by at least a double-fistful of excellent writers. Aldiss somehow assembled a couple dozen marvelous G.E. stories, and mortared them together with sparse but thoughtful and thought-provoking introductory material. I even loved the little business of putting at the head of each story the original blurb-quote that introduced it in its original pulp appearance; it gives one some idea of the limitations within which these writers were working.

The series is not perfect (what is?); a few of the stories do creak audibly. But overall the Spidermeter (stories enjoyed x 100) registers in the high eighties or low nineties, and that's high praise these days. These are not just good-to-excellent stories—they are good-to-excellent stories which, for the most part, I had never heard of before, and that impresses me.

A worthwhile addition to anybody's collection.

I first read Richard Matheson's *The Shores of*

*Space* when I was nine years old (I lost my sf virginity at the tender age of five; t'was Robert Heinlein who broached me, bless him), and the book made a deep impression on me. But then, so did *Tarzan of the Apes* at that time. I hadn't seen *Shores* since, and just a few months ago I came across a devastating critique of it by Damon Knight, in his collection of critical articles *In Search Of Wonder* (it's right there on the shelf next to the Pepperidge Farm and the Arnold Brick Oven), available from Advent: Publishers. The dissection was extensive and bloody and supported by examples from the text, so I chalked off *Shores* as one of those childhood treasures that won't survive adult reinspection.

And as you've surely guessed by now, a review copy subsequently arrived, and turned out to be almost as good as I remembered.

In looking back over the two books covered in the opening Bitter Disappointments section, I notice that each disappointment was quite "well written." That is, in all three cases, lucid and literate sentences formed engaging, page-turning prose that told a bad story. Matheson comes from the other direction: in his case absolutely dynamite stories are told in engaging, page-turning prose whose sentences frequently are hilariously bad. This is quite unusual; as a general rule a person who can't write a sentence can't tell a story. But Matheson can string together sentences like "Across her face, the hot wind fanned bluntly, ruffling the short blond hair," "She drew in a heavy breath through her open mouth," (ever tried it through a closed mouth?) and "He blinked away the waves of blackness lapping at his ankles," into a story that nails you to your chair, doubles your pulse and turns



your spine into a tube of liquid helium ("Being," the lead-off story). The clumsy sentences formed a good part of Knight's criticism; indeed examples one and three above are cited in his attack. Further, I would have to say that some of the stories in *Shores* are a bit padded, with just a little more unnecessary redundancy that was absolutely called for by necessity. (But do you have any idea how little they were paying per word in the forties and fifties?)

But in terms of sheer *story*, at least seven of the thirteen tales in *The Shores of Space* are genuine classics. The aforementioned "Being" has figured prominently in my nightmares since I was nine; "Pattern For Survival" is a four-page story that left me laughing and crying; "The Test" is a chilling story about an old man who must pass a test to avoid euthanasia; "Trespass" concerns a woman who couldn't be pregnant but is (ah, but with *what?*); "The Curious Child" is a horror story with a happy ending (how many of those have you seen?); "The Last Day" has been many times anthologized, as has "Little Girl Lost." The other stories range from fair to very good, and the worst of them was, if memory serves, made into a pretty good *Twilight Zone* episode ("Steel," about a broken-down robot prizefighter and his infinitely more durable owner/manager).

There are very few gorgeous or brilliant sentences in this book—but some damned good storytelling. 95% on the meter.

I'm afraid that's it for pleasant surprises. All the rest of the tidbits skewered on this month's shish kebab are books that looked like they'd be good and were. It's simple, really: all you need do is read an

average of one sf book a day for five years (which I certainly couldn't afford until I got this job), and you too will get pretty good at picking books that are, for you at least,

### *Sure Things*

Fredric Brown (1906-1972) was and for that matter still is the unquestioned master of the sf short short. Other writers have occasionally managed to cram as much story into three pages or less (Isaac Asimov comes immediately to mind), but no one else has done it so often or so well. Of course, the short-short has never been a wildly popular length with writers (no obscene jokes, please). First of all there's the word-rate—Brown once sold a story for less than the postage it cost him. Second, they're *harder* to write than longer stories. Finally, you lose the chance to sell a short-story collection, because who in their right mind would publish a book of nearly fifty short-shorts?

Bantam, that's who, and may their own shorts never chafe. *Nightmares And Geezenstacks* is a delightful can of 47 mixed nutsies, absolutely bite-sized and inordinately piquant—and I defy you to eat just one.

I must add that short-shorts are not all Brown did well—he also produced some very good novels, some excellent short stories (toward the end of this book we find one or two as long as ten, even twenty pages), and some marvelous novelettes (has anybody out there got a copy of "Angel Worm"?). But if you sometimes have to snatch reading-time in ten

or fifteen minute chunks (in other words, if your print-addiction is as advanced as mine), *Nightmares And Geezenstacks* is the book to keep in your back pocket. Whimsy, irony, extreme cleverness and remarkable compression.

*Kinsman* is by way of being the "prequel" of Ben Bova's magnificent *Millennium*, the novel that inexplicably failed to make the Hugo Ballot a couple of years ago. While it's by no means in *Millennium's* league, it definitely belongs next to it on your shelf.

Ben has been writing about Chester Kinsman for fifteen years or more now, in short stories and novelettes published in *Analog*, *Fantasy & Science Fiction*, *Again*, *Dangerous Visions* and *20-20 Visions*, and several times anthologized. Since the Kinsman saga culminated in such an excellent novel (free, by the way, of the Sagamania defect), it was logical to put all the previous material between a single set of covers too, taking Kinsman from his arrival at the Air Force Academy to his appointment as Commander of the American Moonbase. This might have yielded a great short story collection—but instead, Ben did some substantial rewriting, and turned it into a novel of character.

He also added a few paragraphs planting bits of plot matter for *Millennium*, so as to make the books work as a two-volume set. But they are by no means extensive or intrusive—a reader unfamiliar with *Millennium* would not put down *Kinsman* feeling ripped off, only mildly puzzled about one or two paragraphs. So it works as a prequel without falling prey to Sneaquequel Syndrome.

I've wanted to read this book since Ben told me it was going to exist, and I was not disappointed. Get it, and if you haven't got the other, get that too.

There really is no such thing as a sure thing. It's conceivable for instance, that some day Terry Carr will publish a worthless anthology (the day after the postal rates go down and the income tax is abolished).

But *Universe 9* is certainly not it. It was everything I expected from a Carr anthology (a lot) and much more (a whole lot).

I mean, eight good stories out of nine is nothing special for Terry, standard performance. But here we have an outstanding Greg Benford story about a 13th century phonograph record ("Time Shards"); plus the first published story of Mary C. Pangborn, sister of the late great Edgar Pangborn (the 21st century's Mark Twain) and clearly in his league; and best of all "Options," the finest John Varley story since "The Persistence of Vision" (which at this writing has won the best novella Nebula and will unquestionably walk away with the Hugo before you read this).

All by itself "Options" made up for the bad taste left by *Titan*; when I finished it I sat right down and wrote Herb a long love letter that began, "Varley you sonofabitch: this has *got* to stop. You must *stop* writing stories that make me smile and weep." And when my wife Jeanne finished it, she wrote John a letter saying, "How can you know the inside of a woman's skull so well?"

In Varley's future history, people change their sex like you and I change socks. At last he got around to writing about the *transition period*, when sex change is an easily available option (just grow a clone of the opposite sex and do an everyday brain transplant) but not yet widely accepted. Herb focuses on a woman, a chief architect and

mother of three, who is enormously intrigued by the notion—with a husband who feels enormously threatened by it.

Look, a writer is often selfishly glad to read a truly seminal story by someone else—because almost invariably some aspect or avenue has been left unexplored which *he* can use. But Herb has simply written the definitive sex change story, and he did it in a goddam *novelette*.

And that ending is absolutely perfect. "Options" alone is worth the price of *Universe 9*, and the book would have been a good buy without it. 95% on the Spidermeter.

*A House In Space* was a sure thing for me at least, because I read the hardcover a couple of years ago, reviewed it elsewhere in glowing terms at that time, and subsequently made heavy use of it as a reference source for my most recent novel. But I can't pass up a chance to recommend it again, and the paperback edition just arrived.

It is a journalistic account of what it was like to live in zero gravity for up to 84 days in Skylab, and it is one of the most fascinating books I've read, the kind you read aloud to people and they *don't* ask you to stop. Henry S. F. Cooper (appropriate initials) is a *New Yorker* staffer who is very damned good at his job. He did not settle for NASA PR handouts—he goes into some detail about the mutiny, for instance (oh, you hadn't heard about that? The first "sitdown" strike in space?)—but he still got 54 great photos out of NASA. And engrossing anecdotes from the astronauts themselves: do you know why astronauts fetch lots of horseradish? Or why it is physically impossible to get dizzy in

free fall? Or why astronauts fart constantly?

*Most highly recommended.*

The first and last paragraphs of the above review can be applied verbatim to G. Harry Stine's *The Third Industrial Revolution*. It is the basic primer on the industrialization of space, and I think it will ultimately prove to have been the most influential science fact book of this century. I do not make such a statement lightly: though there are some trifling deficiencies in literary grace, the importance of this book simply cannot be overstated. Us sf types have been dreaming wistfully of going to space for decades now; Harry is the man who knows how to actually get it done, and this book tells the story. Buy a dozen copies and mail one to every millionaire you can find, and you can vacation on Luna in your lifetime.

And now a closing announcement. I spoke at the beginning of this column about my chronic hour shortage, and it's been getting worse lately. To do one of these columns, what with reading the books, thinking about them, writing about them and typing up the results (not to mention the time spent on handling and processing the hundreds I didn't read), takes about three weeks minimum out of my life, and it pays me a handful of cashews and free books (most of which are overpriced). I've got a couple of novels I want to write, and a family I'm starting to feel I'm shortchanging. This may strike some of you as either Bitter Disappointment or Pleasant Surprise, but this is my last *Destinies* column.

It's been fun. Don't take any wooden characters.



# **THE IMMORTALS: FROM PRINT TO FILM AND BACK AGAIN**

by James Gunn

"Science fiction supports  
logic and order,  
sf film illogic and chaos."

## Preface

In September of 1969 ABC-TV launched its "Movie of the Week" series; it consisted of 90-minute films made especially for television, and it was intended to improve the rating position of ABC, which then was a poor third to CBS and NBC. In the late Sixties films seemed to be drawing the biggest audiences, but new feature films were scarce and expensive.

The second film of the ABC series was "The Immortal," an adaptation of my novel *The Immortals*, which had been published seven years earlier. Ten years before Desilu Playhouse had presented a television adaptation of my *Galaxy* story "The Cave of Night" as "Man in Orbit" starring Lee Marvin and H. G. Marshall, so the experience was not unprecedented, but this was different. "The Immortal" was almost a film, and if it was successful it might lead to the first prime-time television series to come out of science fiction itself.

Film and television traditionally had treated science fiction shabbily. I realize that science fiction films and even television shows have their fans and that some of these are even science fiction readers, but I believe that when science fiction readers watch sf films or television they either are turned off or they turn off their critical judgments. They do not hold sf movies or television shows to the same standards they apply to their reading.

I have put on film series in connection with my science fiction classes, and I can come up with about enough films for a one-semester series, enough to count of the fingers of three hands. When I was younger I used to think that "Things to Come" was the only good sf film ever made. Now



I'm not so sure of it, at least the first third, but I'm willing to compromise on "The Lost World" and "Metropolis" for historical reasons, "Frankenstein" and "King Kong" for thematic value, and such other films as "The Invisible Man," "Destination Moon," "When Worlds Collide," "The War of the Worlds," "Forbidden Planet," "The Time Machine," and "2001: A Space Odyssey." Even for these one must make excuses; "2001" comes closer than any to being both good science fiction and a good film.

Science fiction was successfully translated to radio. Why has it been so difficult to translate it into the visual media?

John Baxter, in his 1970 book *Science Fiction in the Cinema*, says that written science fiction and science fiction films have different roots. "Science fiction supports logic and order," he wrote, "sf film illogic and chaos. Its roots lie not in the visionary literature of the nineteenth century, to which science fiction owes most of its origins, but in older forms and attitudes, the medieval fantasy world, the era of the masque, the morality play and the Grand Guignol."

But that begs the question of why films can't do a good job with science fiction as it is written. One answer may be that science fiction is a literature of the imagination, as is radio, while film is too concrete; its images are restricted to those on the screen. Another answer may be cost. Films cost money; even television films cost money. And money is conservative. The quality of a radio show may be dependent only on the script and the actors and the ingenuity of a sound-effects expert, but a film requires scenery and special effects. Money wants guarantees; that is why film and television tend to be imitative. Money decisions usually get

made on the basis of what has been profitable before: a lot of monster films followed the success of "King Kong" and a lot more "The Creature from the Black Lagoon." Only occasionally does money take a chance on a producer or director, such as Stanley Kubrick or George Lucas, who has been successful.

Moreover, science fiction at its cold, cold heart is idea fiction. Film makers distrust ideas; they deal with images and emotions, and they don't know how to put ideas on the screen. What they fail to realize, I believe, is that ideas can be just as emotionally stirring as love, hate, and fear. "Eureka!" shouted Archimedes in his bath and dashed naked through the streets of Syracuse. Surely the intellectual fear that the person next to you may be a monster in human form can be just as terrifying (and more pervasive and meaningful) than the elemental fear that a vegetable creature needs human blood to nurture its seeds.

Finally, film makers and television producers hate to surrender control of their processes. Although they may not understand why people read science fiction, they are not willing to listen to those who do. Ben Bova has described his experience as technical consultant on "The Starlost," and even Harlan Ellison has had difficulty making his voice heard on a variety of projects. Those science fiction films that science fiction readers respect have been made when someone who knew something about science fiction was close to the production, as H. G. Wells was to "Things to Come" and Arthur C. Clarke was to "2001."

After 1969, of course, came such films as "Star Wars," for me a delightful fairy tale with science fiction trappings, and "Close Encounters of the

Third Kind," a science fiction epiphany appended to a teaser for UFO fanatics. Both were surprisingly successful; in fact "Star Wars" rewrote the definition of film success. On the evidence that science fiction imagery, at least, is not inconsistent with making large sums of money, many science fiction films and television series, including mini-series, are in planning or production. "Battlestar Galactica" already has attained good ratings.

But I am back in 1969—a decade ago—waiting with mingled anticipation and apprehension. It seemed to me that on this anniversary readers might still be interested in how one novel got turned into a television film and then into a series, and what went wrong.

11-10-54 Agent writes that John Campbell has bought "New Blood" for *Astounding*. After that "Donor" was sold (twice) and "Not So Great an Enemy" (Medic) and "THE IMMORTALS."

10-11-1961 Agent sends Bantam contract for THE IMMORTALS.

November, 1962 - Bantam publishes THE IMMORTALS.

6-20-66 Agent writes "I have a guy named Everett Chambers on the hook. He . . . sees some feature movie possibility in THE IMMORTALS and perhaps even a possible tv series to follow that."

7-20-66 Agent sends contract. Two-year option with payments every six months against a final purchase price plus percentage of any movie and

royalty on each series tv show.

9-6-66 Agent sends first option payment: "So it's gone that far, anyhow, and may it go at least a way farther."

2-6-67 First news in six months. Agent sends second option payment.

8-5-67 First news in six months. Agent sends third option payment. Oh, well, I didn't expect much more.

5-18-68 Haven't heard for more than nine months. Agent and I have parted, but don't think that's the reason. Two-year option period is almost up. Am busy with public relations for University but finally write to Los Angeles to lawyer listed on contract: way I read it I am owed final option payment whether project goes ahead or not.

5-29-68 Chambers writes "Sorry there has been a delay . . ." Money welcome but no news about film.

6-4-68 Bob Specht, scriptwriter, who was with Chambers in the option, writes: "It may seem to you from where you sit that not a great deal has been happening with THE IMMORTALS." But he and Chambers submitted the work to every major studio and almost every independent movie-making organization in Hollywood, as well as almost every major star and director and were turned down. "My own enthusiasm for the project has never waned, however, and in the past few

months I've been trying some areas completely on my own . . . and I've been able to arouse some interest. . . . There may be a very good chance you will be hearing from me in a week or two. Please let me know, therefore, where I might call you." Exciting—but this sort of thing has happened before, and the calls usually don't come. I write and send my phone number at home and office. (Bob later sends the reaction to *THE IMMORTALS* of a reader at Fox, dated, curiously, 3-11-66, before Specht and Chambers made their first inquiry about rights: ". . . futuristic collection of nightmarish events . . . lack of specific direction is distracting. . . . As a novel it offers very little for the screen. An interesting idea, however, is presented in the first two stories. The discovery of the elixir vitae and the resultant search for the donor and his offspring offers a new twist on the old manhunt theme. There is just enough science fiction to be far-out but there is also a story line present which could be developed, especially from the Cartwright angle."—Looking back on this later, I am astonished at the way in which subsequent events echoed the opinions of this first reader: new twist on old theme. Was he prescient: Is there a standardized Hollywood mind?)

6-12-68 Bob is different: he calls—Chambers is discouraged and wants to pull out; Bob has agreed to carry on alone and has faith, and a prospect. He got involved when he picked up *THE IMMORTALS* from book rack in office where he worked as a West Coast editor for Random House; he thought first section, "New Blood," a perfect piece of writing. Decided then it would make a great movie; still

thinks so. Went to work as script editor for short time and talked colleague, Chambers, into taking an option with him on THE IMMORTALS. Now needs six-months' extension of the option to protect himself while arrangements are proceeding. No extension, I say, but will sign a new contract calling, among other things, for residual television payments.

6-24-68 Sign new contract dated 8-1-68. Bob writes that he has a meeting with the head of New Projects Development at Paramount. Since he probably will want changes, Bob will incorporate them before he sends me a copy. He'll be wanting my ideas. "I'd rather not confuse you with areas in the present approach that may finally be discarded." A few days later check arrives with memo: "Still working on the prospectus and hope to have it in final form by the end of the week. *Must* have it done, in fact, because I'm going to be working on a John O'Hara project at 20th-Fox next week."

7-28-68 Bob writes "we're beginning to move." Drew up prospectus; studio interested enough to want changes. Good sign. Studio: Paramount. "Sometime within the next couple or three months we may very well have a purchase deal. If they feel the prospectus is right, they'll take the whole thing to the TV networks. Should they make a deal with one of the networks, we've got ourselves a sale."

8-11-68 Bob sends 7-26-68 Daily Variety front page: "Paramount-TV has signed Robert Specht to develop 'The Immortals,' sci-fi novel by James Gunn, into a two-hour vidfeature. . . ." Bob says it ain't so:

"no further news on IMMORTALS. As soon as I hear—positive or negative—I'll be in touch with you speedily." Does Daily Variety know more than Bob? Bob thinks I should have Hollywood agent to develop full film potential of my work and sends some of my other books to his agent and others. One, Jack Stewart, is interested, makes arrangements with my current New York agent to try to sell some motion picture or TV rights. Bob and I agree to meet in San Francisco during the World Science Fiction Convention over Labor Day.

August—Bob sends the prospectus for THE IMMORTALS. Much like the book only with some significant changes to place the dramatic emphasis on the Immortal (a drifter named Marshall Cartwright in book, who sells blood, is warned by doctor, and seen no more until the final section, briefly, he now is Ben Flowers and he has a love interest, Laura Pearce, the doctor's daughter.) Business with Laura and Ben escaping together at end, Laura wounded, Ben saving her life at risk of own, and then condemned to wander forever. Still some suggestions of philosophy and social problems of immortality.

8-13-68 Send Bob four-page analysis of prospectus, stressing the identifying characteristic of mainstream science fiction (pragmatism and cold rationality) and suggesting that the prospectus allows too much sentimentality to creep in. Suggest opposing the cold rationality of the antagonists to the human desires of the protagonists. Point out that the theme of THE IMMORTALS is that too much of a good thing is a bad thing, that people can

be too healthy. Suggest that Dr. Pearce be kept alive but under surveillance, his research secretly funded by Weaver, that the concept that Weaver age again more slowly (one year a month instead of a matter of days) is harder to rationalize than mine and provides less urgency to getting another transfusion. Don't care much for the love interest, particularly the doctor's own daughter; maybe a nurse:

Late August and early September. Have a good World Science Fiction Convention in Berkeley but Bob cannot make it.

10-3-68 Bob writes "I think we may be running into a snag at Paramount . . . in the form of the vice-president in charge of production who recently came to Paramount from Fox. He saw THE IMMORTALS at Fox and wasn't crazy about it then. The point is that since this is not *his* project—and I can't blame him—he's not anxious to see it done. We'll know in a week or two one way or another." Bob says Fox execs like his FROM THE TERRACE presentation, and Bob thinks that if IMMORTALS doesn't make it at Paramount he can take it back to Fox. "Eventually we are going to make it."

11-4-68 Bob calls. Deal going through with Paramount for an ABC "Movie of the Week" with series possibilities. He needs an extension of present option agreement with another option payment in addition to final contract price. Sure.

11-9-68 Bob sends renewal papers. Says he'll be starting on an outline for the script in a few days.



12-4-68 Get letter from a Paramount Picture v-p, forwarded from Bantam, asking if motion picture rights to THE IMMORTALS available. Irony. Write Bob. Write v-p that Paramount-TV has option on rights.

11-27-68 Bob sends option check. Television cock-eyed business. Had meeting almost three weeks ago with two execs in charge of THE IMMORTAL (that's right, it's singular now), and at that time they were in a terrible hurry to see a step outline. Wanted to get to script fast. Would hear from them in a couple of days, since they'd like to start shooting in March. Now two weeks since they got the outline and no word.

12-26-68 Paramount v-p writes "unfortunate that 'The Immortals' will end up as a television movie rather than the full-length feature it deserves to be. Although our company is at Paramount, the separation of powers between feature pictures and television projects are such as to create enormous problems in trying to get the television division to give up their efforts." Try to get him interested in THE JOY MAKERS or the manuscript of THE BURNING but he eventually turns them down.

2-7-69 Letter from Bob. Been too busy to write, but first draft of screenplay done last Monday and now at ABC. "The next stage will be to receive their reaction, after which I'll go on to a second draft and shortly after that to a polish. It's a standard routine." (And so it was. Predictable. Maybe too predictable?) Bob feels sanguine. A good sign:

"Paramount put the script into mimeo the day after I handed it in, making only minor changes, and then rushed it off to ABC . . . I've made a great many changes from the presentation. The major one is that the Immortal is now a man who holds a job, has a fiancée and leads a normal life; the story thus becomes one in which a fairly ordinary man finds himself burdened with an extraordinary gift. It's less gimmicky now and I think you're going to like it." (Wanta bet? Looking back, this many be where the project began to go wrong; I suppose it sold the movie and its momentum carried it onto the series, but the life in it began to flicker in that "fairly ordinary man.") "I'm almost sure we're going to go all the way. . . . Plans are to go into production in mid-March if all goes well. . . . I was only given a month to complete the screenplay, but I have the feeling that much of what you wanted to say is in the finished product while at the same time ABC's demand for an 'action-adventure' story has been met." (Ah, "action-adventure," we have not seen the last of you. Can we sense some of the compromises that have begun to dictate the shape of the movie and the series yet to be?)

Late February. Bob calls in the evening. I am out. Wife makes notes. Project going into production. Casting now. Maybe Lee Majors will be Immortal. (Who is Lee Majors?)

Mid March. Memorandum from Bob. Cast complete: Ralph Bellamy, Barry Sullivan, Carol Lynley, Jessica Walters, and Chris George as the Immortal. (Great cast, but who is Chris George? Look up Rat Patrol. George is dynamic. Wife says he has appeal.)

3-28-69 Letter from Bob on Paramount TV letterhead enclosing publicity release from Paramount. Douglas Cramer announces Movie of the Week. Lou Morheim will produce, Joe Sargent will direct. "Everyone here has high hopes," Bob writes. Shooting schedule will be two weeks. (Two weeks?) He will try to get schedule so that my son Kevin and I can go out to see some of the shooting.

4-18-69 Lou Morheim's secretary sends final script at Bob's request. I have mixed feelings about script: professional, good dialogue, plenty of action, suspense. But somewhere in there the idea is lost, and the focus is on pointless matters, with elements of mysteries, chase, westerns. . . . I can't believe the ending with its old gimmick of the leap over the bottomless canyon. Eventually tell Bob so. He hints at studio and network hand.

4-27-69 Arrive in L.A. with Kevin for six-day visit with old friends, science fiction writers, and others as well as Bob. Next day meet Bob opposite Paramount gate. Paramount looks like an old factory in a run-down district. Bob looks like an artist: medium height, slim, dark, intense, friendly. He takes us on the lot—a moment of uncertainty and possible loss of status as guard stops our car, but he has Bob's name on his list and lets us drive on. Go to Morheim's office. Friendly, unassuming, a writer himself, he asks me what I think of script. "It's a love-hate relationship," I say. "I just hope you know what you're doing," Bob laughs. "Nobody does out here," he says. Kevin and I go with Morheim and Bob to studio, a dark cavernous place littered with

cables and dark sets where cast is shooting bomb shelter prison scene. Everyone businesslike, capable; impressed with set and efforts of everyone to create a good show. Go to lunch at commissary with Bob and Morheim. Kevin and I stare into John Wayne's belt buckle. (Next day we see Paul Newman; don't know who is more impressed, Kevin or me.) Tell Morheim about my new book, *THE BURNING*. Later we see dailies of Braddock's plane crash. Bob leaves and Morheim takes us back to the set and tells us to watch the shooting as long as we wish and to come back any time while we're here. We watch them shoot scene in hospital corridor when Sylvia is dying. Only person to speak to us on set is Martin Silbersher who seems interested in fact that I wrote the original book. Later, at dinner, Bob asks us how it went. "Fine," I say, "nobody paid any attention to us." "The most unnecessary man on the set," Bob says, "is the writer of the script, and if that's true think what the position of the writer of the original material must be like."

5-14-69 Bob writes that the shooting went well, finished about half a day ahead of schedule, and both ABC and Paramount are delighted with the dailies and everyone's even more enthusiastic about the possibilities of a series.

Mid June. I suggest that *THE IMMORTAL* might get some publicity by being premiered at the World SF Convention in St. Louis. Publicity man at Paramount finally calls, but nothing comes of it.

7-15-69 Bob writes to exercise his option to buy the television (but not the motion picture) rights. (Any-

one want to buy the motion picture rights to a great book?) Encloses his check. Also a letter saying the show turned out well. "The general feeling is that it's got an excellent chance to emerge as a series, but no word will be definitely forthcoming until after it has been shown to some test audiences."

8-15-69 Memo from Bob saying he's heard THE IMMORTAL is going to be aired on the 30th, he thinks. "Also, it's been tested in front of an audience in one of those fancy reaction places and it came out better than any other M.O.T. Week up to this point. On a scale of 0 to 95 I don't think it ever went below 85 and kept hitting the top. I saw a screening a couple of days ago. It's good, damn good. Hope you like it better than you did the script."

Mid-September. Call from Bob in which he mentions seeing Chris George at a screening, and Chris was shaking, not out of concern about the show but out of hope that it will become a series. Also quoted a top ABC executive who told him that THE IMMORTAL was not only the best movie of the week but the best movie of the year.

8-30-69 THE IMMORTAL is the second Move of the Week. First one a big disappointment; why would they start a new series of movies with something that poor? ABC advertises both heavily, including full-page ad in New York Times and ads in other papers. Like buying an audience for something new, but how else would anyone know to tune in? Invite friends over to see show with us. Pretty nervous and don't enjoy it much, although name in big fluorescent orange is magnificent. A good show, I

guess, though not my book—at least the canyon jump at the end has become a small stream. People seem to like it, maybe because of the production and the cast, maybe because the germ of my idea is still there. When asked, I say, "I think they wanted to do a good job and tried to do a good job of what they knew how to do." Reviews are mixed: local review is good, HOLLYWOOD REPORTER says "title seems prophetic, if this does indeed develop into a series," DAILY VARIETY objects to standard plot elements, lack of exploration of the theme; I agree but hope the reviewer is wrong.

Mid November. Bob sends memorandum saying there has been much good reaction but nothing will be forthcoming from the network until January. Thinks we've got a very good chance for a series. Has had offers to do other shows but turned them down. Encloses 11-5-69 Joyce Haber column from L.A. TIMES saying Chris George has been besieged with offers since his starring role in THE IMMORTAL, which was the second-rated show in that week's 70-market Nielsen (whatever that is). . . . But other deals will follow the IMMORTAL "which looks like a sale as a series for the fall of '70."

2-27-70 AP story in local newspaper lists ABC's fall shows. One of them is THE IMMORTAL, Thursday. Call Bob to congratulate him. Bob out. His wife says Bob didn't know himself until yesterday. Meanwhile Bob has sent me the front page of the 2-26-70 DAILY VARIETY with ABC's fall schedule and "Congratulations!" written boldly across the front. Later, critics comment on ABC's "counter-programming strategy," which depends heavily upon drama.

Mid March. Bob and Paramount lawyer call to ask for my approval to a novelization tie-in with the series; lawyer offers one-third of whatever royalties first and future novelizations might bring in. Original contract with Bantam included the right for Bantam to do any novelizations; this gives me a contractual position as well. I think about it. Later call back and agree.

Mid March. I go to Berkeley for Nebula Awards day and to film lectures for my course on science fiction in Berkeley and L.A. Also lecture to Harry Harrison's science fiction class at San Diego State. I stop in L.A. for quick lunch with Bob, tell him among other things that I could recruit some skillful science fiction writers (with TV experience) to tear themselves up for the series, the first to come directly from the science fiction field itself: they have a stake in seeing it succeed. Why should Hollywood writers care? But I hear later that an executive decision has been made to stay resolutely away from science fiction writers.

4-1-70 I mail Bob some suggestions about the series, all sorts of story ideas, pointing out particularly that I hope it is an evolving story rather than a cookie-cutter series. I point out that the motion pictures and television have done almost nothing with science fiction. Said that if the people involved really cared, they'd invite me out as a consultant. Not much hope, really, but have to try.

Mid April. In a memo Bob says it's a poor time to suggest anything like consultation to the producer.

He already has too many execs breathing down his neck, has dozens of people to hire, and is still reeling from audience reaction tests as to ways to go on the show. Bob is pessimistic about possibilities later, too. He doesn't think they want anything from either of us. A bit later he writes that he sees now that there is no room for either one of us on the show. The executive producer, an extremely talented guy named Tony Wilson, needs a story editor with long experience in television.

Mid April. Editor at Bantam calls, gets me at English department where I have gone for conference, asks if I would be interested in doing the novelization of the pilot screenplay. I'm interested but can't do it until June when my vacation starts. Must have the ms. by first week in May, says Eileen. Why not just reprint *THE IMMORTALS*? I ask. There's a big difference between your book and the screenplay, Eileen says. You're telling me! I say. I'll think about it, I say, and call you back. I think about it, make arrangements to take three weeks of my vacation, and call back to say I'll do it; if I don't nobody will. I start the following Monday but get call that afternoon saying ABC has policy against writer doing novelization unless he did the screenplay. Ridiculous, I say, Bob Specht was on the phone when I was asked for my okay on the novelization. I go back to the University. Thursday Eileen calls again. ABC is satisfied. I end up writing on Monday, Wednesday, and Friday (I teach on Tuesday and Thursday), try to average twenty pages a day, no rewrite, average twenty-five, solve some technical problems of the novel, learn much about the difference between a screenplay and a novel, prefer the novel. Can't get



any more than 170 pages of ms. out of 85-page screenplay. Eileen isn't concerned. We'll print it in big type, she says.

Mid May. At Kansas Cultural Arts Commission meeting, Wichita ABC-TV station manager asks about series, recently met ABC exec in charge of THE IMMORTAL for ABC. I tell him my hopes and fears. Later he calls exec, calls me with message that exec would like to have lunch if I get to L.A. I call him. Pleasant. Says he'll set up lunch for July 6, have producer there, etc.

7-6-70 Have lectured at Stanford and spoken at West Coast science fiction convention, hearing dire stories about series and its lack of interest in science fiction and sf writers. Have lunch with Alan Sacks and Tony Wilson. Both delightful people. No pretensions. Want me to know what they're doing with series. Ask my ideas. Seem to listen. Tony is particularly interested in my concept of Ben Richards' psychological development, his growth in the series. Asks if I'd ever do a television script. Suggests I send him ideas. Says he has read and enjoyed THE IMMORTALS. I wonder if he is merely being polite but resolve to send him a thorough analysis no matter what.

7-9-70 Get letter and two sample scripts from Tony Wilson. "I am also very interested in pursuing any ideas you might have for the series," he writes, "particularly in the area we discussed—the first philosophic plateau that a man like our Ben Richards would reach in his endless odyssey." Appreciate letter; appalled by scripts.

7-15-70 Tony hadn't asked for comments on the scripts, but I send them anyway, pointing out only the more obvious and correctible aspects.

7-20-70 Send Tony a 14-page report on the series, not harking back to the original book but starting from their take-off point, the pilot. Report is hard-hitting; it points out the difference between the soft-headed, slow-learning television man (Ben Richards) and the realistic, quick-thinking science fiction man (ironically, he is much more like the dying tycoon Braddock in the pilot). Point out how superficial are themes being developed as compared to the basic themes of life, love, freedom, and death with which the series should be concerned. The most important way in which Ben can develop is to become smarter, more realistic about his condition, about his relationships with other people, about his pursuers. (Notice, later, that Ben does get a little smarter, not much but a little.)

8-18-70 Finally hear from Tony. Thanks me for report. "Your thoughts, critiques, and analyses were most perceptive, and even now are being used to indoctrinate writers as to the true thrust of the show."

8-19-70 Write to Tony about doing script or fuller treatment. No answer.

Mid August. See item in newspaper about a Chrysler assembly line worker who says his blood (with anti-Lewis B serum) is worth \$12,000 for transfusions. Send to Tony with comment, "Life imitates art."

Late August. CBS and NBC schedules show that THE IMMORTAL will be opposite the second hour of the CBS Thursday night movie and Dean Martin show. Tough.

9-1-70 Cynthia Lowry's AP television column is about THE IMMORTAL. In television styles science fiction and fantasy are out and action-adventure is definitely in, and that is how THE IMMORTAL is being played. Chris George, she reports, carries a clipping about some man whose blood type is so rare that he earns \$12,000 a year selling his blood to a research center. (They missed the point. And make an action-adventure show out of THE IMMORTAL when there are dozens of other action-adventure shows that don't have an idea? They really missed the point.)

Mid September. Letter from L.A. lawyer forwarded from Bantam asks how he can get in touch with me about publication of THE IMMORTALS. Can be one of two things: he has a client who wants to buy some rights or who wants to sue me. Can't think of any reason I can be sued; send him letter. He writes back: "I was informed by the Writers Guild that you had deceased approximately two and one-half years ago. . . . I sincerely hope that your death is more apparent than real. . . ." (He has confused me with screenwriter James Gunn, whom I had been sorry to hear had indeed died before I had a chance to meet him, although I had once talked to him on the telephone when another confusion came up over the Desilu telecast of "Man in Orbit," which was adapted from my story "The Cave of Night.") Turns out that a client had registered in

1963 an idea similar to THE IMMORTAL. I tell him to forget it. THE IMMORTALS came out in 1962, and the first story, "New Blood," in 1955, and I had been a spectator at the whole development of the movie of the weeks and the series.

9-24-70 The series premieres. The preceding week the re-run of THE IMMORTAL as a movie of the week had clobbered the premieres of the NBC and CBS shows, I read. But THE IMMORTAL is up against THE DIRTY DOZEN. I see no advertising; the only tie-in with the pilot was a promo afterwards. What does this mean? The premiere is nicely filmed but a re-run of the same ideas in the pilot. This is one of those shows Tony was telling me about in which Ben's links with the pilot are cut; but why do they have to nurse one idea so long? Ideas are cheap. The critics are not encouraging: "Like *The Fugitive* before him, he is on the run—in this case doomed to spend the whole cliché-choked series fleeing an aging and baleful billionaire (David Brian) who wants to siphon off a few pints."—Time. "The Immortal could be a bloody bore," says the Kansas City Star. "The wild rides, careening cars, fights and narrow escapes may prove diverting," says Cynthia Lowry for the AP. "Dull," says the Hollywood Reporter. "They've got a good thing going if they don't stub their toes along the way," says Daily Variety. "Perversely a hit it will surely be," says old friend Harlan Ellison in the Los Angeles Free Press, "for it offers nothing but movement and action." "The series will hold the attention of action-thirsty viewers," says Barbara Zuanich in the Los Angeles Herald Examiner. "The ad agency graduates who tailor the network pro-

grams for prior sponsor approval gamble too recklessly on viewer credulity, or gullibility, with this sort of stuff," says Bob Williams in the New York Post. "A disappointing emphasis on mindless action," says Harry Harris in the Philadelphia Inquirer. "Geritol should get the hint: run for your life," says Jack Gould in the New York Times. "Good escape television—and I mean 'escape.' I never saw so much burning rubber and squealing tires in my life," says Percy Shain in the Boston Globe. "So ridiculous that one felt sorry for Christopher George and the rest of the cast," says Ben Gross in the New York Daily News. "The premise is silly enough to begin with and last night's episode was one big chase," says Eleanor Roberts in the Boston Herald Traveler. "I doubt it will be as immortal as its title, but George is a strong performer and these eternal chase shows seem to do very well in the ratings," says Cecil Smith in the Los Angeles Times. "Chris George runs for his life like a fugitive but with more action and less dramatic plausibility and impact," says Clarence Peterson in the Chicago Tribune.

Mid October. Bob Specht reports that the show is in trouble. Tony Wilson is out as executive producer and Howie Horwitz, the producer, has replaced him. Be prepared to see the show go down the drain, he says. I suggest to Jack Stewart that he send a copy of my report to Tony Wilson around to Horwitz; maybe they'll be desperate enough to try something original. Bob writes again that the execs are no more interested in hearing from him or me than they were interested on taking on any writer Bob suggested, hiring Bob, hiring the original pro-

ducer, or hiring anyone else who had anything to do with the original success. It's a common syndrome at the studios, he says.

11-6-70 A TV column in the Kansas City Star reports an interview with Chris George. The word is that *THE IMMORTAL* is not immune to the ratings and that it will be canceled next month.

11-6-70 Mildred Hird at Bantam calls. An independent producer is interested in the movie rights to *THE JOY MAKERS*.

POSTSCRIPT. The producer who was interested in *THE JOY MAKERS* had more taste than money. That is a more common experience for an author than the project that makes it to the screen or the tube. Bob Specht told me once, before the series started: Look at it this way—one book out of a thousand gets optioned for television, one option out of a hundred gets made into a pilot, and one pilot in ten gets turned into a series. "We've come a long way."

Actually, a producer had been interested in *THE JOY MAKERS* even earlier; he wanted to make it into a film bigger than "2001," but his financing didn't come through either. Another producer would be interested later. Still another story of mine, "The Reluctant Witch" (for which I wrote a screenplay), has been optioned four times and twice shooting had already started before the projects were canceled. Since then a producer has had an option on *THE LISTENERS*, and now a playwright has had an option on Jack Williamson's and my novel, *STAR BRIDGE*.

As Kurt Vonnegut would say, "So it goes." ●

# THE PREDATORS

by David Drake

Daisies do too tell!  
And as for geraniums...

Illustrated by Suso





Above the buildings slid air cars. A single private vehicle, as luxurious as any of those above, shared the street with the wheeled trucks and buses. The closed rear cabin was empty but the chauffeur, a youth whose uniform matched the landeau's smoke-blue paint, drove with the arrogance of one conducting a prince.

In front of the Coeltrans Building he nudged his wheel to the right, edging up over the curb between a pair of trucks unloading yard goods. Pedestrians leaped to avoid the blunt prow. Smiling, the chauffeur set the brake, cut the alcohol flame to idle under the boiler, and tilted a wing mirror to check his appearance. Shoulder-length black hair framed a face whose complexion was as unnaturally brilliant as the best parchment. His lips were red and well-shaped and cruel.

Satisfied, he slid from the ground car's saddle and entered the building, leaving his vehicle for the cameras to watch. They scanned this street as they did every street, every room, in the State; and at the first sign of someone tampering with the car, a monitoring computer would alert the police.

Within the large, single room, narrow aisles separated booths selling fabric and garments. Even during daylight the inner tables were lighted by glow strips to bring out the colors of their merchandise. Eyes turned toward the chauffeur as he passed, some drawn by his iridescent livery but many by his carriage and frame. The body beneath his tight uniform would have done credit to a *kouros* of ancient Athens. He acknowledged the glances only by hooking the left corner of his mouth into a more pronounced sneer.

At the spidery framework of the elevator in the center of the room he halted. Four slim, chromed

vertical rods rose from the floor here all the way to the roof of the building. The chauffeur touched the call plate with his ID bracelet; the radio-caesium key imbedded in its silver threw a switch invisibly and the cage began to whine down from the fifteenth level.

Shop owners in the Coeltrans Building were used to the activity, but there was a stir among their customers. Many of them had never seen a working elevator before. The cost of power to run elevators made them rich men's toys—and rich men had air cars to get them between the top-floor suites of their fellows. Supported by the four thin columns, the cage sank through one-meter circles cut through each level. Little more itself than a floor with a waist-high rail plated to match the verticals, the cage appeared shockingly frail. A more substantial construct would have sometimes blocked the fields of the three scanning cameras covering each floor. No citizen, no matter how rich and powerful, could be granted that potential for secrecy.

The chauffeur stepped aboard and the cage began to rise. He lounged back against the guard rail, whistling as his fingers beat time against the chrome. On each identical level, banks of clerks looked up from their desks as the cage rose past them. The motor in the elevator's floor raised it effortlessly past stairs which were theirs to climb every time they reported to work. The elevator was for Citizen Wilhoit alone—and for this youth.

Only on Level 15 was there a break in the vistas of desks crammed into 60-meter circular floor plans. Here the outside walls were pierced not by windows but rather by translucent panels cast in various pastels. The room was actually brighter than those below it, however, because of the sheets of

sunlight-balanced glow strips in its ceiling. Underlings sat in ordinary desks around the level's outer perimeter, but the central twenty meters were held by a jungle of potted plants and a single huge mahogany desk no less impressive for the litter of papers and instruments on its surface.

The cage stopped. The chauffeur continued to whistle, his back to the mahogany desk and the gray-faced man beginning to stand behind it. Then the current surged through the elevator's handrail and snapped the chauffeur into a screaming arc.

Alternating current of over 6000 volts tends to fling away those who touch it, saving lives that lower voltages might have taken. DC instead camps and holds and kills; and to avoid inductance losses, Greater Greensboro and most other cities now ran on direct current. The charge ripping through the chauffeur's body broke his ribs with unrelieved muscle contraction, and the screaming stopped only when there was no more air to be forced through the lifeless throat. Seconds later the flow cut off as suddenly as it had begun, and the charred body slumped to the floor of the cage.

The cameras on Level 15 recorded every visible nuance of the death.

Lacey gave the final command to the Crime Service computer. It would send a Red Team after the airport smuggler he had identified following a week of studying the operation from every angle. He swung the scanner helmet up against its counterweight and grinned his wolf's grin of accomplishment. His hand was massaging the old scar on his neck and holding the glow inside him when Billings, the investigator at the desk to his right, got up. "You knocking off too?" Billings asked. He was a



blond man with a round face and a quick smile.

Lacey came out of his reverie. He looked at his neighbor, then at the clock across the circular room. 15:40. For the past three nights he had caught cat naps at his desk as leads branched and twined and he wanted thirty hours a day to study scanner images. "Might, yeah," he agreed. There were five hundred desks and investigators on Level 17 of the State Building. Lacey knew and cared as little about Billings as he did about any other of his co-workers.

Billings was straightening the pleats of his collar. "I put in for two hours in the target range," he confided to Lacey's disinterest, "but really I got a date. *Love-ly* girl, lives in the section next to ours. We're going to a time house and buy an hour of privacy. It'll cost a bundle, but it's worth it to keep my wife from learning."

Before Lacey could make his noncommittal reply, the light on Billing's desk blinked orange and the blond man stiffened as information came through his mastoid implant. He swore with frustrated bitterness, punching his left palm with his other hand. "She'll *never* believe this," he said. "They've cancelled my range time and given me an accidental death to check out. An accident!"

"Maybe the computer's a secret puritan," Lacey said, more of a smile on his mouth than in his eyes.

"I always get the leftovers," Billings whined. "You think they'd give me a murder where I could get a little recognition? Hell no! But let some clod touch a hot wire and fry, they drop it in my lap and expect me to work every bleeding hour till I prove it's an accident. And you *can't* prove something didn't happen!" Billings thudded his hands together again. "That tight-assed bitch Sutter's had her thumb on me ever since I offered to give her the time back when I was first on the unit. She won't let the Net give me any decent assignments!"

Billings' face suddenly smoothed and he looked at the close-coupled man still listening with bare politeness. "Look, Jed"—Lacey had never called Billings by his first name, did not even remember it—"look, for me this damn thing'll take forever, checking out the number of times each electrician burped for the past year before the Net'll take a negative report from me. But if you took the call, hell, you know how they'll pass just about anything on your say-so. You do five minutes' scan and report 'no crime', they'll clear it, and we both get the afternoon off."

The younger agent saw and misinterpreted the chill in Lacey's eyes. "Ah, say . . . Marie's got, I

mean, she's got friends and . . . I think maybe we could—"

"I'll pass on that," Lacey said very softly. The scar on his neck stood out in relief against the veins pulsing there. He caressed it with his stubby, gentle fingers. "But I'll take the call, yeah. I didn't have much on for the afternoon."

"You're a champ, Jed," Billings said, squeezing Lacey's biceps and then striding quickly toward the stairway. He was toying with his collar ruff again, a beefy man who would always be allotted bottom-priority calls and would never understand why.

Lacey sighed and pulled his scanner helmet back down to cover his head like a fat, black artillery shell. Quirking his left ring finger to activate his implanted link with the Crime Service Net, Lacey said, "You just routed a call to station four-three-seven. Transfer it to me and give me a current scan."

"Accepted," said the computer voice from Lacey's mastoid, and the Net tapped his helmet into the output of one of the cameras on Level 15 of the Coeltrans Building. The screen showed emergency technicians who were laying a body on their medicomp, a dull-finished unit that looked like a coffin on casters. God knew why the men bothered, because the charred corpse was clearly beyond repair by any human means. There would be little enough of the victim to send to the Reclamation Depot after Lacey had cleared it for processing.

The rest of the level was normal enough, eccentrically furnished but in the fashion that executive levels of powerful corporations could be expected to be eccentric. Part of the work force was still at its

desks, following routine as though that would deny the ghastly incident in the center of the room. The remainder were divided between those elbowing for a closer look at the body and those forcing toward the staircase, waiting to be passed by the bored Red Team securing the death site. No one sat at the broad mahogany desk which stood like an island in a green sea of carefully-tended plants.

Lacey triggered his implant. "Section six," he called, naming the imaginary sixteenth portion of the scanner's view which showed the guard rail of the elevator. "Twenty magnifications." The image zoomed and Lacey could see that what appeared to be a single gleaming circuit was actually divided by four thin insulators, so that each of the verticals of the shaft was insulated from the others. The victim's carbonized skin lumped two quadrants of the ring. Since the rods had to hold the power cables for the elevator's motor, stripped insulation was the obvious cause of the death. As Billings had said, a five-minute job.

Suppressing a yawn under his helmet, Lacey ordered, "Okay, give me camera two at the time the line shorted."

Obediently the Crime Service computer switched to data stored in the vaults that extended for miles under Greater Atlanta. In Lacey's helmet screen the chauffeur stiffened as the jolt crossed him. A blue nimbus threw his screaming face into high relief. Behind him, rising from the big desk, was a man in conservative clothing with a face as transfigured by horror as that of the victim itself.

"Bloody hell," Lacey whispered. He recognized both men. "Bloody *hell*," he repeated. Then he flicked awake his computer link. "What's the prior-

ity on this call?" he demanded.

"Tenth," replied the computer. Its programming did not allow it to add, "Of course."

"Well, better raise it," Lacey said. "You've handed me a murder to clear, and I may need a hell of a lot of help to prove it."

The car was waiting when Lacey swung through the outside door. On his mere statement the Net had rerated the assignment to Priority Two, a comment as to where his stock stood with the computer on the basis of his past performance. The new rating included use of a State vehicle and driver, which Lacey took immediately to the scene of the death. He loved the scanner helmets and did most of his work seated under one; but he could not use them to question witnesses, and he had some questions he needed answered.

Transit time between the pad and the Coeltrans Building was four minutes. Lacey did not waste them, using his implant to get an ID and economic data on the victim and the man behind the mahogany desk. The first was easy. "Terrence Oscar Silvers, age 23; licensed ground vehicle driver employed by the Company for Electrical Transmission for five years, nine months," stated Lacey's mastoid. There was a pause. "Robert Sawney Wilhoit, age 47," the computer voice resumed. It halted. In a different timbre it requested, "Access code, please."

Without surprise or concern, Lacey punched his 8-letter code on the panel set into the back of the driver's seat. Wilhoit's wealth and authority had been obvious from the setting of his office; it would have been unusual if he had not used his power to



see that idle thrusts into his personal life should be turned aside. Lacey on a murder call did nothing idly, and he could be as difficult to turn aside as Juggernaut's carriage.

Assured of Lacey's authority, the data bank continued, "President and Chairman of the Board of the Company for Electrical Transmission. Developed and holds patents on three basic processes in DC voltage step-down technology. Extensive holdings in various corporations, primarily in the field of electronic components and design."

Lacey's driver was tapping him on the knee and calling, "Coeltrans Building, sir." They were twenty meters above the roof pad of a modern cylindrical structure. One of the vehicles already parked on the roof was a ten-seater with leg shackles and wristlets on several benches: the van that had brought the uniformed police in response to a howl from the computer.

"Fine, set us down," Lacey said. They stuttered to a halt at the stairhead. "Crime Service," he muttered as he brushed past the uniformed man stationed there.

"Hey, why didn't you just turn us loose through the Net?" the patrolman asked. "You didn't have to show up yourself." Lacey ignored him and stepped down the stairs into the greasy stench of the room below.

In the nervous chaos of the fifteenth level was a woman who had not been there when Lacey had scanned it minutes before. She was tall and fat, wearing stained coveralls. She sat on a wheeled toolbox and shouted angrily into a phone clipped to it, "You stupid son of a bitch, there *can't* be a short. We were *touching* the bleeding line thirty

seconds before this beggar fried!" Sweat was bright on her forehead and heavy jowls, and her knuckles were white with her grip on the phone.

The electrician's shout had quieted the room so that her partner's voice from the speaker was clear as he replied, "Look, Margie, the meters show the juice came from the emergency generator. Nobody could've gimmicked'em with us working here, so it was a short. And for god's sake, what else could've done it? Bloody lightning?"

"Crime Service," Lacey said to the woman. "I need to ask you some questions."

"Oh, god," she murmured. Her flesh had lost all resiliency and gone gray in the blaze of the glow strips above. "Oh. . . ." Everyone in the room was staring at her and the investigator. "Will they—" she began and choked back her own words. Looking up at Lacey with a sudden fatalistic calm she started over. "Will you put Jim and me under the Psycomp for this? Will you wipe us?"

"You'd better tell me what happened," Lacey said neutrally.

She shrugged and stood, towering over him. The hand phone made a premonitory squawk and she cut it off. "They hired Jim and me—Coeltrans did—hired us to cross-connect the elevator. It—" almost without pausing, she drew a rubber glove onto her right hand and gestured with two fingers—"runs up cog rails in the verticals, these rods. Two of the rails are hot, insulated from the outer surface of the pole but feeding juice through the gears themselves to the motor in the cage floor."

Lacey leaned forward for a better look at the slots in the inner faces of the chrome supports. "Get back from there!" the woman snapped. "I got

one deader on my conscience already today!"

Lacey blinked at her without emotion. "Go on," he said.

"We were supposed to set up a current path in the other two rails, too," she said, wiping her face with a sleeve. "Separate service from an emergency generator, a failsafe in case something went wrong with city power. We punched the lines through by section, but we kept the circuit shut down except for testing at night after the building closed. There were bubbles in the insulation, so until we got 'em out we couldn't charge the line when anybody was around. In case, in case. . . ." She nodded toward the corpse though she refused to look at it again. The technicians were now fitting the body into a pressure-sealed bag to be carried down to the street. "We'd got all the shorts out of it, we thought, but we weren't quite done testing. Guess I left the switch on last night but it seemed safe—we were touching the posts, *touching* them, Jim and me just before this guy . . . went."

"Why run a generator circuit to an elevator?" Lacey asked. He was watching the electrician's face.

"Why does anybody want an elevator at all?" she replied. The fear was gone, replaced by a dawning curiosity. "It was for the boss himself, Wilhoit. You know, he's a regular guy? Last night he—*oh god!*"

All of the fat woman's confidence suddenly disappeared. If she had been gray when Lacey first spoke, she was white now with memory. "He was watching us last night when we ran the tests, moving the cage up and down. Talked to us some—hell, he was the boss, we couldn't tell him he couldn't hang around when we were working. Nice guy. But when we were packing up, he grabbed rails three

and four—the new circuit, you see? Took one in each hand and I thought, 'Thank god we've got all the bugs out'. But we hadn't, you see? Just for some reason the line didn't short then, waited till this afternoon and got this stiff instead of, instead of . . ."

"I want you to find that short for me," Lacey said, "you and your partner. He's in the building too?"

"Down in the basement," the woman said with a nod. "We were redding up when the floor manager called and said somebody'd died." Her open face suddenly coalesced into a frown. "Look, you trust us to check this out?"

"I don't need a Psycomp to tell if somebody's lying to me," Lacey said. "You stay straight with me, like you've been so far, and you'll come out of it all right."

"All right," she echoed. "All right, then wait thirty seconds and I may have an answer for you." She knelt at the base of an elevator support with a multi-windowed instrument in her hands. Holding it against the pole, she ran a dial across its scale and then used a pair of insulated pliers to bridge the two segments of handrail the victim had been holding when he died. The spark was fat and blue and snapped like a pistol shot.

"One'll get you ten that's it," the electrician said matter of factly. She began to put her tools away. The current had eaten a chip out of the nose of the pliers. "Inside the chrome plate, each rod's filled with Dorafeen. It's easy stuff to use, you inject it like grease and let it set. It's hard, it's strong, and it's a hell of a good insulator usually. But if you trip a block of Dorafeen with a magnetic field of whatever the block's loading frequency is, you can get it to

conduct like so much copper."

She gestured with her chin. "That's where the whole company started—Citizen Wilhoit came up with a process using Dorafeen to chop high-current DC into AC to run through transformers to step it down. Anyhow, we bored the columns for our power lines, then ran a bare aluminum cable through them. No need to insulate since there was a centimeter of Dorafeen all around the wire. Except we never thought that if the right—wrong—frequency magnetic field was generated right alongside it . . . well, you saw what it did to the pliers when I'd primed it with my tester."

"But it's just a temporary conductor?" Lacey asked.

"Sure, depends on the mass and a lot of other things," the woman said with a shrug. "A couple seconds for this block, milliseconds for the wafers they use in power stations. I wouldn't have believed that a microgauss field could trip that whole rod, but . . . that's the only way the accident could've happened. Some coil with just the right number of windings, laid against the column and switched on while the elevator was being used."

Lacey's tongue touched his lips. "I'll call you if I need anything more," he said to the fat woman, dismissing her. Her face smoothed in relief and she began to roll her tool chest toward the stairs. Raising his voice to cut through the whispering, Lacey addressed the whole room: "All right, who's the highest official on this floor right now?" Answering murmurs were too confused to be intelligible, but a hundred faces turned and triangulated on a plump little man, one of those still seated at his desk.

Lacey grinned so that his teeth glinted. His neck

scar was tense and stiff and crawled beneath the skin. "Let the rest of 'em go, Corporal," he called to the chief of the uniformed patrol. "You and your boys can blast too. I'll just talk to this citizen a moment about what happened."

The red-capped police stepped aside and began filing up to their car, precipitating a rush of civilians down the single staircase lest the agent change his mind. The seated man watched Lacey approach with the intentness of a rabbit awaiting a blacksnake. Like Lacey, he was dressed in gray, but in a muted solid instead of the tiger stripes that blurred the agent's outline. His beard matched his suit in color, a short, smooth arc that seemed a little incongruous beneath the baldly pink skull.

"Good afternoon, Citizen," Lacey said. "Your name and position, please?" He could have gotten the information as quickly through his computer link, but the opening question, the first thrust into his subject's persona, was a needed part of this interrogation.

"I'm Lewis Ashby and I, I assure you that I have far more to do than concern myself with, ah, drivers," the plump man said. His voice was generally steady, his tones rotund—but his eyes would not meet Lacey's.

"You knew Silvers, then?" Lacey prodded gently. "Knew he was a driver?" He and Ashby were about of a height, but the investigator was standing and dominating the clerk physically. He had let his overblouse fall open so that the holstered needle stunner was visible at the level of the civilian's face.

"I didn't say I knew him!" Ashby blurted. "You don't have any right—I don't care who you are, you can't put words in a person's mouth!"

"Did he always use the elevator when he visited Level 15?" Lacey asked, his voice still smooth but his muscles hardening slightly.

"I don't know."

"Umm, well . . . do you know how a Psycomp works, Citizen Ashby?" Ashby's face tilted up at the question, the mouth in a grimace or snarl, the eyes open. He said nothing. Lacey reached down, took a handful of fabric at the other man's throat and guided rather than jerked Ashby erect. "Maybe I'd better tell you, then, because it could be you'll be spending a long time in one yourself. You see, they give you a short-term anesthetic and slip you into a nutrient bath loaded with oxygen. Filling your lungs with it takes the anesthetic, but your body adapts to the system just fine.

"And you lose a little muscle tone, sure, but they won't really atrophy. The techs, though, they've run leads into your brain and as you lie there fed and filtered and breathing without being able to blink, a computer starts playing games in your head. It feeds in signals and sees what your brain does with them. Pretty soon it knows your head better than god himself does. It gets the answers to any questions it's been programmed to ask, and it goes around correcting any things that it's been programmed to correct. So long as it's in there anyway, you see."

Lacey's voice was the husky purring of a cat about to feed. His face was close to Ashby's and he was speaking with great distinctness. The clerk's eyes were bright with panic, and only the touch of Lacey's hand on his garments kept him from bolting. "It's not . . . comfortable," Lacey said, "lying there while a machine turns over every rock in your

mind. And sometimes something goes wrong. Sometimes the computer goofs and a fellow comes out normal enough to look at but ready to kill at the slightest provocation, the least little thing that doesn't go his way . . .

"Oh—I forgot to tell you where they sink the leads into your skull, didn't I?" Lacey added. He tossed his head so that his brown-blond hair flew back from his forehead. With his free hand he touched two fingers to the white dimples at the hairline. "They go here. At least they did on me." He dropped Ashby and the softer man sagged into his chair like a scarecrow with half the stuffing gone.

"Now do you want to tell me about the driver?" Lacey asked; and through his sobs, Ashby told him.

Robert Wilhoit was afraid of heights. Not to an incapacitating degree, but enough that when he had made it big he had begun to travel by ground vehicle despite the awkwardness of not being able to skim over the commercial traffic. For at least the past year, Silvers had been Wilhoit's driver.

The first time Ashby had seen them together was a day that the clerk had arrived early. Wilhoit had left his car and purred up the elevator while Ashby trudged the fourteen flights of stairs to which his position made him subject: no one but Wilhoit ever used the elevator. Three weeks later, the chauffeur had shared the cage with his employer, his haughty smoke-blue livery pressed tight against Wilhoit in the narrow space; and soon after that, the young man had his own key to the device and frequently rode it alone.

"I've worked for Coeltrans for twenty-three years," Ashby explained. Once started, the year of anger that had built up in the clerk spewed out like



pus from a squeezed boil. "That's from the day, the very *day* that Citizen Wilhoit incorporated. Did he ever let me ride his elevator? Did he even speak to me, say, 'You're doing good work, Ashby'? Ha! But this little, *greasy* child. . . ."

Ashby raised his face and cupped hands to Lacey, pleading for the agent to understand something that he could not articulate. "He would ride up the elevator, get off at one floor or another. He didn't have any business in the building, he was just a driver. He talked to the younger clerks and the senior people, the floor managers—yes, me!—couldn't stop him. We were . . . we were afraid."

"Did Citizen Wilhoit ever, ah, threaten anyone for trying to get Silvers out of their work area?" Lacey asked.

The clerk grimaced, unwilling to answer the question but unable to avoid it even in his own mind. "Nobody tried to. We were afraid. The whole thing was . . . wrong. Citizen Wilhoit was ignoring it all, pretending that nothing was going on. Except that when this *person* went up to the Citizen's desk and whispered to him, they would leave together. Again and again. . . .

Lacey looked over at the slab of oiled mahogany. Most top executives would have placed their desks on whatever part of the outer wall gave them the best view. Because Wilhoit disliked heights, his desk was central. The ceiling lights pooled brightly around the desk and the serpentine rings of foliage about it.

Lacey stepped over to the plants where the outermost circle of them lapped against the elevator. Festoons of tubing to carry water and nutrients linked the individual pots. He touched a squat

plant whose leaves were like narrow fingers streaked with yellow and green. "Really likes plants, hmm? Don't any of them have flowers?"

"They're Citizen Wilhoit's hobby, not mine. If you want to learn about them, you'll have to ask his gardener."

"Even a gardener?" Lacey said mildly. There was a flower, after all; a pink geranium in a pot beside the elevator. Part of what snaked from its foliage was not plastic tubing but wire.

"Of course a gardener," Ashby was saying, but Lacey was no longer listening to him. The agent had unsheathed his hand scanner and was recording every detail of the apparatus connected to the geranium. The room's three integral scanners covered it in the sense that if it had been empty, at least two lenses would have born on every centimeter of surface. In practice, although opaque objects over 80 cm high were strictly controlled, there were blind angles near the floor which only spot checks by human operatives would record. By chance or otherwise, the geranium was in such an angle. Two short loops of wire were clipped to the leaves. At the other end they disappeared into a sealed, fist-sized box tacked to the nearest post of the elevator.

"What's this?" Lacey called back over his shoulder.

Ashby looked startled. He stood and peered over at where the agent knelt. "No, I told you I don't know anything about plants."

"Not the plant, for god's sake, the box!" Lacey snapped. "You know about electronics, don't you?"

"Certainly not. I'm an accountant, not a, a technician."

Lacey's expression went briefly flat and his scar stood out. Then he began to chuckle. He was laughing fully, open-mouthed, as he walked past the cringing clerk and up the stairs to where his car and driver waited.

Level 17 was lighted and busy when Lacey got back to the State Building, though it was technically after quitting time and most of the floors below had emptied. 17 belonged to the hunters, and the good ones were lonely people. You couldn't take a companion under a scanner helmet with you. Some investigators worked long hours for the thrill of the chase, some because they tracked criminals by rote and had by now no other way to order their time. Lacey worked like a slave at an oar bench, driven by an overseer no one else could see. No one, at least, besides the Psycomp which had shunted his profile to the attention of Crime Service recruiters at the same time it carved away Lacey's ability ever to rape another woman.

His Unit Chief was waiting for him, seated on Billings' chair with her legs crossed at the knees and a glass of something sparkling in her hand. She set the drink down and smiled as the agent approached.

"Hello, Ruby," Lacey said, sitting on the edge of his own desk. "Slumming or hiding?"

The Crime Service Net was a huge computer complex that directed its agents with more than mechanical skill, but it could not interface them with the world. That job took humans—not hunters themselves, but humans who could understand the terrible loneliness and exhilaration of the

hunters, who could cushion them against the realities of housing and economics and sex. Ruby Sutter was one of them, and she was one of the best. Tall for a woman, taller than Lacey's own meter seventy, she looked slim and fragile until one noted the muscles knotting close beneath the skin; then she looked only slim. Her hair was darker than brunette, and though her normal work did not require her to use the scanners, she wore it in the tight ringlets that would be comfortable beneath a helmet.

"Working, Jed—got your example to follow, you know." Sutter's station was on the fourth level, not the seventeenth. "Had a citizen complaint about you, as a matter of fact, and I was asked to take care of the problem. Asked from pretty high up."

Her face was bland. Lacey frowned in genuine surprise and asked, "Since when do the high-ups care what citizens think, for god's sake?"

"When the citizen looks a good bet to develop a matter transmitter in the next couple years, they manage to get interested."

Lacey slid down into his chair. "Umm. Sure. Wilhoit wasn't around, but he probably had access to scanner inputs from his own building, huh? Not really supposed to, but . . . And I don't guess he liked what he saw, either." The squat man chuckled. "That's real freedom of information, isn't it? A murderer using a scanner to track the cops?"

Sutter took a sip of her drink. "The Net says it's an accidental death. Ninety-nine plus probability."

"Going to pull me off it, then?"

"Not if you say it's murder."

Lacey felt his muscles loosen. He had not realized until then how tense he had been. "That's

good," he said, running a hand across his forehead. "I was going to nail him anyway. Though I guess you knew that already."

"You do your job, Lacey, and leave me to mine," Sutter replied. The smile left her face and she leaned forward, careful not to touch the agent or even threaten to. "But be careful, Jed. You can't push Wilhoit the way you did Ashby. Even with your past record and everything I can do for you, it'll be your ass if you go one step beyond the law with somebody with Wilhoit's clout."

She leaned back and grinned again. "But just between us and the data banks, that was a lovely bluff you ran on Ashby. Pretending the Psycomp had scrambled your brains and you were going to tear him open unless he talked."

"Bluff?" Lacey repeated. "Oh. Well, he was going to talk. He was the kind who would."

Sutter reached out a hand to brush the air inches short of Lacey's arm, a caress in intent but not in execution. Every since the Psycomp had gotten through with him, physical contact with a woman threw Lacey into vomiting and convulsions. Sutter knew that and knew why, as she knew everything necessary to the well-being of her agents. It did not keep her from caring. "You're not going to lose control of yourself, Jed," she said. "Not over Ashby. Or anybody."

She stood and walked away.

Lacey was humming to himself very softly as he pulled down his scanner helmet and began running data on the victim. Silvers had spent four nondescript years driving Coeltrans delivery trucks before being picked as Wilhoit's personal chauffeur after the suicide of the previous driver.

The data bank showed no reluctance to release information on the boy. Unlike the electronics magnate, Silvers was one more out of billions and his file was open to anyone with access to the computer. There was not even need to show cause.

But the life stats were as uninteresting as they were open. So, with a careful precision that combined years of practice with a knack beyond any experience, Lacey began to dig into the scanner records which stored Silvers' whole life.

"Death site minus 30 seconds," he ordered, using his mastoid implant to control the scanner helmet. Silvers' lounging beauty flashed up obediently, one hand on each of two quarter-circlets of railing that would soon be lethal. Lacey flicked the CS Net to attention again. "Tracer request."

"Go ahead," the computer link said.

"Terrence Oscar Silvers. Template as currently on screen."

"Ready." In a microsecond the Net had analyzed Silvers as he appeared moments before his death, taking into account not only externals but details of height and bone structure subject to change only by trauma or the most extensive surgery.

"Same camera, same template—scan to death minus one week," Lacey ordered.

Using the analysis it had made of the victim during life, the Crime Service computer ran the past week's input from the Ceoltrans scanner Lacey had made his vantage point. It quickly found and marked congruent subjects. A man could have made the same check—but only if he had a week to spend. Computer review was labor saving, though in the same sense that a power drill saves labor—per hole. It does not mean that a miner at the rock

face works less hard than his grandfather did, only that he cuts out more ore.

"Two samples," the implant reported.

"Run the latest," said Lacey.

The scene in the scanner was visual proof of the story Ashby had told. Silvers was arriving in his blue and smoke livery, a stim stick between his gum and cheek to diffuse its alkaloids into his bloodstream. His walk missed being a swagger only by its fluidity. Wilhoit was aware of him as of nothing else in the room, but he kept his head bent down and only the tension of his hand on the desk edge was a communication.

The chauffeur sidled between desks, watching with bored superiority as clerks tapped figures into the displays across their desktops. Some stumbled under his gaze. Once Silvers spoke to an employee, a blond boy whose bones must have been translucent to give him so ethereal an air. Lacey switched to another camera for a view of Silvers' lips, but the words were a bland question about how long the other had worked for Coeltrans. The embarrassed clerk only muttered, "Sir, a week is all," but his eyes followed Silvers until the driver left, alone, as suddenly and inexplicably as he had come.

Lacey sent his left ring finger the message to curl. The rerouted nerve triggered his implant. "What's Silvers' home address?" he asked.

"Suite 12, Level 3, 184 West Mangum Street."

'Suite' sounded plush, 'Level 3' sounded plush—a low walk-up but high enough to be clear of the noise and odors of the inevitable stores on the ground floor—and the street address was in the middle of a very good neighborhood indeed. "Same template," same scan frame, Level 3, 184 West Man-

gum Street," Lacey directed.

"Five samples."

"Run the latest."

By law and in practice, every room in the State of over five cubic meters was covered by the interlocked fields of three scanning cameras. The law did not regulate minimum size or occupancy for rooms, but the staggering use-tax linked to every required camera guaranteed that space—and the scanners covering it—would be efficiently used. Silvers' rent was indicated by the fact that his apartment level was planned into fifty suites when many middle-class levels would have held five times as many units in the same area. Lacey's helmet showed him a late-evening scene, Silvers entering from the lower staircase and sauntering along a serpentine corridor to his own suite. He was out of livery, wearing instead a cape and jumpsuit cut conservatively but from lustrous material that flowed through a range of colors. Because the scanners worked on infra-red in the darkness, the precise shades were doubtful; the cost of the garment was not.

The corridors and suites were divided by double floor-to-ceiling sheets of vitril, sound-deadening but kept visually transparent by an expensive static cleaning system. Silvers palmed his lock plate, entered, and began fixing a meal in the kitchen.

"Who's paying for this?" Lacey asked.

The CS Net cleared its throat with a click, then said, "All charges are paid through Personnel Accounting, Coeltrans."

"On whose request?"

"That information is not available."

"A written or verbal order, then, not one



punched directly into the corporation's accounts from a high level. Available to Lacey when he began running scanner images and questioning clerks. He didn't need the knowledge yet, and it would still be waiting for him when he did.

Lacey swung away his helmet and rubbed his eyes. The level was almost empty and the sky beyond the windows was black. "Late," he thought, then glanced at the clock hands illuminated over the far doorway and realized that instead it was early—and not all that early. He did not feel tired, only light and insubstantial and happy in a way that drugs could never leave him. There was one more matter he could clear up through the helmet while it was still dark outside.

"Sample template, same scan frame—Level 9, 304 Corcoran Street," Lacey ordered, shrouding himself with his helmet again.

"One sample."

"Run it."

On the screen flashed a moving image of the anteroom of Hell. In a nation without privacy there can be few statutory crimes. This is neither altruism nor liberality, simply economics. Since every human activity was canned and the inputs monitored by computers which would ring alerts on every instance of activity they were programmed to find unlawful, there had to be sharp limits to make actual enforcement possible by a police force of acceptable size. In earlier decades, patrolmen could be writing parking tickets within twenty feet of a mugging or rape in progress. Now no crime was ignored and, without the lubricant of ignorance which made the old system work, the statute book itself had to be streamlined into the

realm of possibility by a ruthless paring of minor offenses and victimless crimes.

To the State, no form of consensual sexual activity was a crime. Society, however, had a separate opinion.

When poverty becomes the norm, everything is for sale somewhere; but ascetic religion becomes the only real anodyne for the masses. If present squalor is only God's furnace to purify men for posthumous glory, what matter the lack of food and energy, the endemic diseases and the evidence that all over the world Man was staggering down a slope which he was unlikely to rescale. Purity is not a physical fact but a religious state of mind.

Level 9 was the entrance to the accommodation house, the time house, on the floor above. Clients paid for use of one of the hundreds of canvas-walled cribs, each with a single scanner unit mounted in the ceiling above it. You could not shut out the cameras, but the cameras did not care what—consensually—you did or to whom.

In the helmet screen, on the next to the top level of the sleazy residence building, Terry Silvers stood hipshot as his date, a wizened, balding man in a suit of natural silk, paid the attendant to be allowed to climb to the cribs.

"Cancel," Lacey said. He did not need or want to follow Silvers into the accommodation house. No law of the State had been broken there. If Society wished to stigmatize homosexuals as brutally as had Victorian England, if riot squads not infrequently were called to put down the spontaneous violence offered by mobs of the upright to uncovered pederasts, it was no business of Lacey's.

No one in an accommodation house is upright.

"Death site minus 30 seconds," Lacey ordered. Silvers' doomed, smiling face appeared with Wilhoit and the rest of the room beyond it. "Tracer request."

"Go ahead."

"Robert Sawney Wilhoit, template as currently on helmet screen.

"Ready."

"Level 9, 304 Corcoran Street. All samples in the past six months."

"Twenty-seven samples."

"Run the latest."

Another night on the screen but the same guard and Silvers with the same haughty expression as he waited. This time Citizen Robert Wilhoit, inventor and executive, was paying for the crib. He had the rigid look of a man whose legs were being amputated without anesthetic. There were other customers coming down the stairs, a middle-aged man and a woman too plainly garbed to be a prostitute. They avoided looking at Wilhoit just as he did them.

No one was upright in an accommodation house.

"Cancel," Lacey repeated and swung the helmet away. Wilhoit had, perhaps, enough power to escape the Mob's censure, but he could not have escaped his own upbringing. A self-made man rather than an aristocrat raised to believe in the propriety of whatever he chose to do, public exposure of his homosexuality would have horrified Wilhoit as surely as it would have the clerks in his office. And he had been willing to kill to keep it . . . not secret, but unproven. The scanner image was

evidence of motive for the computer. Lacey had already known it, of course, because he had a sharp memory for faces. He had remembered Wilhoit and the victim from a night some months previous when he had seen them together, leaving the accommodation house as Lacey entered it for his own private needs.

Morning was bright in the windows and the room had begun to fill with returning agents. It remained to learn where Wilhoit was at the moment. Using the scanner helmet once more, Lacey checked the magnate's office and found him seated at his desk speaking into a face-covering hush phone.

Lacey stood. "Ready me a car," he ordered the computer. "I'm going to visit an apartment while its owner's away."

The palm lock set in the clear panel of the suite's door was impossible to pick by conventional means. The flat pouch over Lacey's left hip, balancing his needle stunner, held an electronic pick that was by no means conventional. Itself a terminal to the Crime Service Net, its face was a mesh of microscopic beads that raised, lowered, and changed their conductivity under the direction of the computer. If a pattern was on file, the pick duplicated it instantly. If not, the computer ran a random search certain to open any palm lock within a minute.

It took Lacey a little longer than that to get in, because instead of picking the lock he summoned Wilhoit's live-in house staff to admit him.

There were two of them, both men in their forties. One wore the livery Silvers had died in, a burly, smooth-stepping man, obviously a human watch-

dog and obviously angry. Lacey had announced his presence by having the CS Net override every second unit in the suite, ordering the occupants to unlock immediately or face arrest. As the door swung open the guard snarled a quick curse, but he backed off from Lacey's lifted brow and the threat in the eyes beneath it.

The other man was the one Lacey had come to see. He had thin hair and a worn tunic whose loops and pockets held a score of scrupulously clean tools. The light reflected from the myriad plants filling the suite gave the man's pale complexion a greenish cast, and it seemed to fit. He blinked at Lacey with the same mild interest that he might have displayed toward a cafeteria server.

"You're Charles Dornier, Citizen Wilhoit's gardener?" Lacey asked, as an opening rather than because the matter was in doubt.

"Why yes, do you have a delivery for us?" the wispy man responded.

Lacey grinned with something close to humor. "Not exactly," he said. "I'd like to see Citizen Wilhoit's plants, but I'm a Crime Service agent." He turned back to the guard. "You can wait outside in the hall," he said. "And I mean wait. Take three steps away from the door and there'll be a Red Team on you."

Dornier had ignored the words, ignored also the glowering and slammed door with which his companion exited. "It's really a splendid collection," he was saying, "and though I must admit it lacks a certain . . . focus, I suppose, I think the variety makes it far more interesting. Don't you?"

Lacey had already found what interested him. Amid the waist-high rows of foliage were six



geraniums with gray boxes like the one in the Coeltrans Building clipped to them. "What're these?" he asked.

Dornier knelt beside Lacey, warming with pride. He traced a circuit with his index finger. "It was my own idea," he said, "but Robert has gotten very deep in it himself and that's—well, he's a very brilliant man, you know, very brilliant. I've attached electrodes to different portions of the same plant to measure the resistance across the current path. That depends on the number of ions in the veins and the volume of fluid—and *that* can depend on outside stimuli, including thoughts the plant's owner directs at it."

"Oh, god have mercy!" Lacey spat. It had been a rough search already and he didn't need a load of silly dreck to fuzz the edges further. "You're telling me that plants *think*?"

"No, I'm not telling you that, Citizen, and you're not listening to what I *am* saying," Dornier snapped back. The gardener's eyes flashed with anger and an affronted dignity that Lacey could appreciate. He suddenly realized that there was a core of ability in Dornier as real as that within him—that there had to be, or Wilhoit would never have hired him in so personal a capacity.

"I'm sorry," Lacey apologized. "Please explain." He squatted, his rump just above the floor and his face close to the geraniums. The blooms were odorless, but the leaves themselves had a bitter, unexpected tang.

"I've never heard anyone insist that encephalographs think," Dornier said, not wholly mollified, "just because they register brain waves."

"But not thoughts."

"Well, Psycomps then; though perhaps you'll say they do think?" The gardener shrugged, then continued, "But machinery is Robert's field, not mine. And mind you, I'm not saying that my friends here"—he stroked the furry edge of a leaf with a finger that was stained, calloused, and very gentle—"don't think. It doesn't particularly matter to me at the moment. What does matter is that I can make any of these six raise or lower the resistance of their leaves, just by thinking at them from across the room."

For a moment the suite was so still that the drip of moisture from the plant-watering conduits was audible. Lacey rested like a mottled gray stone until he asked, "What would happen then?"

"Anything, anything," the gardener said with a trace of sharpness directed at what he saw as a silly question. "What happens when you flip any

switch? The lights go on, the door opens, the, the rocket ignites. It's a control you can touch at a distance and through walls, that's what it is. What happens here is that the recorder, that's the box the electrodes hook to, marks the peak."

"Umm. And does a little coil energize when that happens?" Lacey's voice was as soft as the fur on a cat's belly.

"You'd have to ask Robert about that, of course. He built the system for me. For us, now—he's been testing a plant himself at his office for the past several weeks."

Lacey looked up at one of the level's scanning cameras. It stared straight at him and Dornier and recorded their every movement. But not their thoughts: that would have to wait for a further improvement in the machinery. "And anybody can do it?" he asked.

"I think so, at least," said Dornier cheerfully, again tracing a leaf with his fingernail. "Of course, it takes a little preparation, a, a tuning of yourself and the plant. Watering it, talking to it"—he broke off quickly and added in response to a comment that had not been made, "I'm not saying that it understands what you say any more than a chameleon understands that bricks are red and leaves are green. It's just a matter of tuning, that's all."

Lacey stood. "You've been a lot of help," he said, "and I appreciate it. And I really believe you've found something here." He walked to the door, looked out at the guard scowling through the vitril. "I'll tell you, though," he added over his shoulder before palming the latch, "I think you'll have one hell of a hard time convincing anybody else."

"Well, with Robert's backing, you know . . . ,"



Dornier said.

"Yeah, well. Good luck anyway."

Lacey whistled between his teeth as he walked to the aircar and ordered his driver to take him back to the State Building and wait. Still whistling, he washed his hands in the male lavatory on Level 14, returned to his desk, and made a quick check with the scanner helmet and the Net.

He was back in the air car ten minutes after he had left it, giving the driver a new destination.

Ruby Sutter found Lacey drowsing at his desk in the later afternoon. He awakened at her approach and his smile was a spreading contrast to the grim set of the woman's face. Billings had quickly ducked under his helmet at sight of his superior. Sutter sneered at his back. With a concern she tried to hide, she asked Lacey, "How close to a kill are you, Jed?"

"As close as I can come without putting Wilhoit under a Psycomp. I know why he did it and how; but to prove it, I'd have to get into his mind."

She slashed her hands and turned away. "Then it's over. There's no way to get him under a 'Comp. No way."

"Sure, that's what I thought too."

Sutter cursed, bitterly and at length. She poised her hips on the edge of the desk and looked Lacey in the eyes. "Jed, I'll be very lucky to save your job as it is. I had another talk with . . . well, several officials. They want you off this Wilhoit thing. If there was a chance you could close it, I'd . . . but if you can't . . ."

Lacey's smile changed as all his muscles tautened. His voice burred, like a saw on hard wood

as he said, "They could come to me directly, these officials. Do they think I might—might take offense at them?"

He laughed suddenly and stood, his laughter genuine—that of a cynic who sees his worst forebodings proven true. "Look," he said, "I know you'd go to the gallows with me, for me, Ruby. That wouldn't do a bit of good. So I *am* going to drop the investigation, mark it as an industrial accident—but I'm going to see Wilhoit one time before I do that."

"I'll come along."

"To hold my hand?" Lacey asked with a grin. "No, you can watch here just as well."

Sutter bit her lower lip. "Look, just let me run down to my desk and I'll be right back."

"Ruby, you wouldn't need a gun for this anyway—and I really don't want you to come. You'd threaten Wilhoit in the wrong way."

"I'm supposed to trust *your* judgment?" she asked, but she bent a smile around the question. She was watching his back as he walked through the door to the landing pad; then she covered her head with his scanner helmet.

As Lacey entered the top level of the Coeltrans Building, eyes all around the room turned toward him like filings aligned by a magnet. The man in the center of the pool of plants was no exception. He stared over the mahogany desk and the litter of charts and tools and components upon it. Paying no attention to the employees, Lacey picked his way through the snaky aisles of plants leading to Wilhoit. The silence was uncanny. Only the hiss of his clothing on the leaves seemed to mar it. "Good

afternoon, Citizen Wilhoit," the agent said. "I'm Lacey."

The executive nodded. "You were here this morning, too, while I was in a board meeting. I would have expected you to check through your—cameras to see if I was here before you came."

"I did." Lacey poised the fingers on his left hand on the desk for support. He looked at ease but the scar on his neck burned like a magnesium flare. "I've been investigating your murder of Terry Silvers—but that's not news either, is it?"

Wilhoit picked up a delicate construct of glass and etched metal. His short, capable fingers turned it over for inspection. Without looking away from his hands, he said, "I didn't kill Terry Silvers. Or anybody."

"But there's evidence, isn't there?" Lacey pressed. "There's all the records you could ask for that he was blackmailing you—"

"Citizen," Wilhoit said, now staring in the agent's face. His voice was no less vibrant for being pitched too low to pass beyond the circles of plants surrounding him. "You can prove my—orientation, if you want. And you can prove that Silvers was using the threat of exposing it to extort things from me that he would not have been granted otherwise. He was an animal, yes, a predator more interested in the fact that he could ruin a powerful man than in any real benefits the fact brought him, but yes. . . . What you don't have proof of, because it doesn't exist, not in any form the Justice computers could accept, is that I killed him. And so you can't arrest me, and you may as well leave."

"Oh, I can arrest you, all right," chuckled Lacey.



"If you're right, of course, you'd be released as soon as you had your preliminary hearing at the State Building."

"And you would be fired, perhaps even prosecuted under the circumstances."

Lacey ignored the comment. "You gave Silvers a key to the elevator," he said. "You knew how the support rods were constructed—you're the sort who would—but I'll bet you checked the working drawings anyway before you ordered the work done on the elevator. That I could prove."

"It wouldn't mean anything." Wilhoit had set his electronic tracery back on his desk.

"Then you rigged the recorder for your geranium experiment," Lacey went on, "so that it had a coil of the right frequency to trip the Dorafeen in the column. You could have used an electronic trigger instead of the plant, but computers understand

electronics. Sure, the coil'd do something reasonable as well, move a stylus or the like—but you're used to thinking about multi-use components, aren't you? And then you waited for the right time and . . . conducted your experiment. Quite a job of planning." He looked sidelong at Wilhoit. "What, ah, formula did you use to send the plant off? I think I'd try something like, 'You are life; I am life; we are one in the universe', since the idea is to blend with the plant."

"You too," Wilhoit said. His breath was hissing as he rose to his feet, his flesh gone sallow and trembling. "Just like Terry, aren't you? The lust for a chance to bring down someone who really can do something important in this wretched world. But you won't do it, either—if your scanners don't show a damned thing, you can't prove a damned thing. Now get out!"

Lacey straightened. His face was a mask. "Robert Sawney Wilhoit," he said, "by virtue of the authority vested in me by the State of North America, I hereby direct you to accompany me in order to be formally charged in connection with the murder of Terrence Oscar Silvers."

Wilhoit slammed the desk with his fist. "You're going to play this farce to the end? I'll be released as soon as your Receiving Unit processes the charges. Do you think that people of the level who *could* override the computer's decisions are going to *want* to, to destroy me just so that you could win your game?"

"It's not a game, Citizen," said the agent with a smile as stark as a naked skull's. "It's my life. Winning, beating people like you, is about the only thing I've got left since they put me under the

Psycomp. I can't lose. I can't afford to lose." He took a breath that shuddered like the wind in a loose-braced sail. "Come up to the air car."

"No!" Wilhoit shouted. He looked around, saw the open mouths of his staff gaping at him. "No," he repeated in a lower voice, "I'll meet you at the State Building if you must, but I won't ride in an air car. You'll have to shoot me to get me in one."

"Suit yourself," the agent shrugged as if it did not matter. "I'm not worried that you'll try to run. Go on down to your vehicle, then."

Feet clattered on the stairs from the roof pad—Ruby Sutter, wearing a high-necked sheath of red and orange and a death mask in place of a normal expression. Lacey moved to her swiftly while Wilhoit, still standing, began to poke buttons recessed into his desk and speak soft commands to the



microphones they activated.

"I was watching you," Sutter said. They were in the middle of hundreds of clerks, all straining to hear but afraid to look up at the two intruders. "You know that Receiving can't hold him. Jed, for god's sake don't throw yourself away! There's still time—"

"There's no time." Lacey looked back at Wilhoit who, his conversation with attorney or politician finished, had shrugged on an outer jacket and stepped to his elevator. Lacey took from his side pocket an empty plastic bag with a sealable edge and the glitter of a few drops of water within. His fingers toyed with it as he concentrated on something else.

Sutter bore his silence briefly, then demanded, "What've you got there?"

"Oh, I washed my hands this morning and saved the water to pour in that geranium," Lacey said, pointing to the recorder-linked plant by the elevator shaft. Wilhoit's head had just sunk below floor level. "It struck me that wash water might be a faster way of getting in tune with a plant than what Wilhoit's gardener was mentioning."

His unit chief blinked in puzzlement. "I don't understand," she said.

"Wilhoit would," said Lacey.

A scream burst from the elevator shaft, cutting through even the roar of a high-voltage arc. It hung over the blank faces of the clerks as smoke and the stench of burned meat began to bubble out of the shaft.

"I can't afford to lose," repeated Lacey.

Sutter looked at his face and shuddered. After a time, the screaming stopped. ●

# WHAT KIND OF LOVE IS THIS?

by Jack C. Haldeman, II



If it feels good  
it is good. Right?

Illustrated by Steve Fabian



It was the best of all possible worlds, no doubt about it. Utopia at last. All sweetness and light, milk and honey. An age of unlimited opportunities. Something for everybody. Everything for everybody. Whatever they wanted.

So why was Frank unhappy?

It was a puzzle, he shouldn't have been. There was no reason, not in this day and age.

He had a good job, but he didn't like it. Four hours a day down at the plant, working with his hands. It used to give him pleasure to bend wires, assemble circuit boards, but now it was just something to do. Just a job he punched in and out of, never giving it a second thought after he walked out the door from the plant and onto the lifter towards home.

He had the standard family, wife/two kids, but he felt distant from all of them. It was a gulf he couldn't seem to bridge. Most times it hardly seemed worth the effort. The kids were away at Hutch, anyway. They only came home for two hours on Saturday and Sunday. He hardly knew them. Sometimes they came on birthdays and that always threw Frank off guard. He could never keep birthdays straight, never knew quite what to say to them. Frank felt he treated the kids as if they were too young, or, sometimes, too old. It bothered him. He was glad Hutch took care of them.

His wife was ChiChi tonight, a teevee starlet who was the current rage of the late-night talk shows. Sharon had gone to the molders this morning and come back ChiChi. All breasts and blonde hair. Dumb as a rock. He had trouble remembering what she had been before. A brunette, or something. Maybe a redhead. But that was last night, or maybe the night before. He'd claimed a headache and



she'd tried all the usual tricks, but nothing worked. Could be that was why she went to the molders this morning. She didn't usually shapechange more than once a month. Old-fashioned that way.

He had been allotted a Tuesday/Thursday mistress, but she bored him. Only two months and he couldn't stand her. If they found out, it'd be another rotation and reassignment. That was more trouble than it was worth. Better to go through the motions and pretend to enjoy it, even though he was sure it didn't fool anybody. He wondered if his wife's lover felt the same.

Unhappy. Could be his hormones. The last time he had hooked up to the autodoc they had come out borderline normal, a little on the low side. That had been six months ago, they could have changed by now. He was supposed to hook up to the autodoc at least once a month, but something had gone wrong with the unit in the apt and it never reminded him like it should. He could go over to the wall and do it now, but he was afraid. There was some sort of penalty for not getting a checkup once a month, it was against the law. He wasn't sure what the penalty was, but it was probably pretty bad. If he went to the machine, it might report his absence. Besides, Frank was only too aware that he was on the edge of Stage IV Mid Life Crisis and he was scared. Even his compulsory Peer Group Encounter Sessions didn't help much. He lied to them, too.

"Frank, honey. Turn off the teevee and come to bed." That was Sharon, his wife. ChiChi, really, at least for awhile.

There were two ChiChis in the room, one on the wall and one in bed. Idly, he wondered which was more real. He pushed a stud in the arm of his chair

and the wall blanked. One of the ChiChis stopped talking to him.

Crossing the room, he went to the sonic for a quick wash. As he was drying himself, splashing FeelGood on his body, he was momentarily startled by the face looking back at him from the mirror. Everyman, model III. A drab face, very ordinary. He wondered why he'd picked it. Usually he let Sharon choose, but he was vaguely aware of having selected this one himself. It reminded him of his natural face, as well as he could remember it. Properly aged, of course; though a little younger than the calendar would have said. Room for a little vanity, anyway. He padded across the GrowRite carpet and slipped into bed with Sharon. ChiChi. The bed made soft breathing noises as it adjusted to his added weight.

Sharon/ChiChi's body felt strange. Heavier, more solid than he was used to. Nice round full bottom, though. He liked that a little. Huge breasts and pouting lips. A body just this side of going to seed. Well, it would be discarded before that happened.

"Want a hit?" asked Sharon/ChiChi, passing him a small wafer. A jolt before sex. The usual routine. He didn't want sex, not with this new, strange creature, but he didn't know how to refuse.

He took the wafer automatically, broke it along the scribed line, gave her half.

"Good times," he said, touching his half against hers in a ritual so old he couldn't remember when it had started. He shivered, though the room wasn't cold.

"Times," she said and popped hers into her mouth. He did the same, turning afterwards to the control box at the head of the bed.

"Music?" he asked.

"Um," she said absently, already sliding down the tube.

The walls of the bedroom fell away and were replaced by a subtle shifting of pastel swirls against a starry background. The Galaxy Prime setting was always good for getting into the mood. He waited for the wafer to take effect.

It didn't take long, and as soon as it hit, Frank wanted off. A bad one, real bad. That just didn't happen to him. Mediocre, sometimes. Bad, never. That was for *sick* people. Nightmares, creeping terrors, childhood dreams raced through his mind. Being young scared Frank more than anything else. Being young meant not having control of your life. At the edge of his mind the pastels became Hutch-masters looming over him, dreaded weekend Moms and Dads.

In the middle of a cold sweat, it came to him like an oasis. A drift of thought, caught and held for a breathless moment.

A tableau:

Frank. Sharon. Eighteen and sixteen. Outside the Hutch on his last day before Jobtime. An afternoon stolen by jiggling the computer a little bit. She held his hands in hers, bent her head down and kissed his long fingers. Her dark brown hair tumbled lazily across his arms. "Sure you will," she said, but the words came easier than the feeling of certainty.

"I want to mold clay, bend steel," he had said. "There are so many wonders buried beneath the surface of stone, awaiting chisels and hands to bring them out. I've taken the tests, given them samples. They can't fail to see that this is what I should do."

"Tomorrow," she said dropping his hands.

He knew what she was thinking. *Tomorrow you will be happy with whatever life they assign to you. They will see to that.* He knew he couldn't fail. Hadn't they already pledged him to Sharon? That had made him happy, made them both happy, and tomorrow . . . Well it *had* to work, that was all.

Sharon turned to him and the tableau froze.

Sharon with a tear, a small diamond, in her eye.

Sharon with one outstretched hand.

Her small imperfections, her natural face.

Frozen that day, that last day of happiness.

Sharon wanting only him and a life together.

He wanting Sharon and a life with purpose.

Sharon as she was, as she could never be again.

Sharon.

Sharon.

Sharon.

Frank struggled against the drug, against the sheets, forced his eyes open. Sharon/ChiChi moved beside him, moaning quietly, eyes glazed, mind someplace else. A strange hand with a familiar touch gripped his leg. He felt numb, dizzy. With a tremendous effort he pushed the sheets aside and slipped from the bed to the floor.

He crawled across the GrowRite on his knees and elbows, unable to stand, looking like a naked soldier in some strange war. When he finally got to the wall he had to push himself up on his knees to reach the autodoc. He strapped the two small leads to his wrists and wrapped the large one around his chest. It clicked softly and a muffled whirring in the wall told him it was starting to work.

"Frank, that you?" said the grotesque Sharon/ChiChi from the bed.

"Uh huh." *Sharon, damnit, were did you go?*

*Where did I lose you? A small pinprick, an injection.*

"Bad trip?" She slurred her words, coming out of the drug.

"Guess so." He felt better already. Something was slipping from him, he couldn't remember what it was. The autodoc chimed softly and he removed the straps. They slid back into the wall and he stood up, energy flowing through his body. Superstud. He felt rugged, handsome, ready to take the world on.

"Come 'a here, big boy, flop my bed," said Sharon/ChiChi, pouting a little. It was ChiChi's famous line, her trademark. What a great new body to explore.

Frank laughed out loud and plopped into bed. He took her roughly and enjoyed every minute of it. Damn, it was good to be alive. ●

# EVERYMAN MODEL III



**science  
fiction  
and  
science,  
part five  
science fiction  
and reason  
by poul anderson**



## SCIENCE FICTION IS TOO IMPORTANT FOR IT TO BE LEFT TO LANGUISH IN ENGLISH DEPARTMENTS

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Pliny the Younger once ended a letter to a friend with an apology for its length, saying that he hadn't had time to keep it short. No doubt some of you who have been following this series have begun to feel it's taking a great many words to make its point, whatever that is. Well, there's good news and there's bad news. The good news is that this is the last part. The bad news is that I won't make any point or arrive at any conclusion.

You were warned at the outset. I only proposed to ramble through the subject, which is the interrelationships of science fiction and science, making any digressions that looked interesting. The hope was to stumble on a discovery or two, or at least a few fresh observations: not to prove a theory or proclaim an ideology. Even the individual essays have been pretty free-form.

To summarize what I've earlier tried to support with examples, let me take one paragraph. Science fiction has no exact definition, nor can it, because it's too diverse and, anyway, its distinguishing characteristics are a matter of degree rather than of kind. Much the same is true of science, whether regarded as a body of knowledge, a search founded on a particular philosophy, or a set of human activities. Still, if we're careful to keep the uncertainties, vaguenesses, and paradoxes in mind, we can talk reasonably intelligently about either, and even subdivide them. "Hard" science fiction is the kind

which, ideally, confines its assumptions to established facts. In that sense, it is closest to science, and is both valid and vital as an art form. However, it does necessarily ignore the likelihood that we will make revolutionary discoveries in the future as we have in the past, and is to this extent unscientific. Moreover, even many of the hardest stories have perforce included a few extra laws of nature, such as the possibility of traveling faster than light. Thus we segue into the category of "imaginary science." Fiction which concentrates on this is fiction which deals with concepts for which we have little or no evidence, or which the evidence may actually be against. Its tie to science is both the recognition that we have a great deal yet to learn and the rationalism which takes for granted that we *can* learn indefinitely much more. Meanwhile, not only are the real sciences today advancing so explosively that no scheme or theory appears to be safe from overnight upset, but the very basis of all science, the axiom that the universe is orderly, has been called into question.

There remain two of my four motifs to discuss, and then we can try to look back over the whole territory we've discovered, regardless of how hazy the view is apt to be. As I have been writing, I've come to agree that editor Jim Baen had a good idea . . . though doubtless he could have picked many better qualified people to carry it out. Science fiction is too significant for the study of it to languish in English departments.

Yes, significant, not in the sense that it can save the world or anything like that, but that it helps recruit from among young readers the scientists and technologists whom modern civilization must

have for survival, and at its best it offers unique ways in which to consider, to symbolize, and to put into human terms the ever stranger world in which we find ourselves. Needless to say, other literary types have their own special strengths. I only claim that our field is *per se* not less deserving of respect. (Sure, the percentage of bad science fiction stories is huge, but we have the right to be judged by our best, not our worst, as the love story is judged by *Romeo and Juliet* rather than by *True Confessions*.)

The idea that science fiction does speak to contemporary man is borne out by the fact that many of its themes have become common currency. Future civilizations, cosmic voyages, alien intelligences, time travel, alternate universes, computers with awareness, artificial life, and on and on . . . most such things can be used figuratively almost anywhere today and raise no eyebrows. They are the stuff of immensely popular movies and television series. Impeccably "establishment" writers such as John Hersey do not hesitate to employ them when it's appropriate. They have even pervaded our jokes, and not just in America. (A friend of mine, spending some professional time in Hungary a few years ago, heard from his colleagues there of the latest triumph of Soviet genetics, the cross-breeding of a cow and a giraffe. This has produced an animal that grazes in Hungary and is milked in Russia.)

Let us not exaggerate our own importance. The reading, writing, and publishing of science fiction are a very, very small part of what humanity as a whole is doing. However, let us not underrate ourselves either. The field is worth close consideration, as still another feature of today's world, one with

its own paradigmatic significance. Its relationships with science are an especially interesting aspect.

Therefore, onward. Besides the motifs of hard science and imaginary science fiction, I set up those which I labelled quasiscience and counter-science,\* and would now like to say a word about them.

"Quasiscience" was the best name I could think of for that with which a large class of stories deal. The implication is that they touch directly on science little if at all.

A hard science story or an imaginary science story is to a considerable extent devoted to exploring the consequences of the author's assumptions. As respective examples, already mentioned, Hal Clement's *Mission of Gravity* is chiefly a guided tour of his wonderfully realized planet Mesklin, whereas Robert Heinlein's "By His Bootstraps" shows what cause-and-effect tangles might result from time travel. Of course, that kind of orientation in a narrative does not preclude skillful writing, three- and four-dimensional characters, philosophical meaning, or any other traditional virtue.

The quasiscience story differs. It may well employ similar concepts, but those are not what it is *about*. The extraterrestrial setting, the mechanized or barbarized future Earth, the routine use of telepathy, or whatever science fiction apparatus, is there to provide what amounts to background for a tale which mostly concerns something else.

Occasionally the quasiscience story becomes a

\*In *Nebula Award Stories Seven*, Lloyd Biggle, Jr., ed. (Harper & Row, 1973)

mere costume Western or spy novel or the like. (This is not to say it can't be well-handled and entertaining, simply that the science fiction elements are wasted on it.) At its best, it is as good as anything else in our field. Indeed, probably the majority of science fiction stories are quasiscientific.

As an outstanding example, let's glance at Jack Vance's "Demon Princes" series, which began with *The Star King*. When all five books are completed, we will have an extraordinary pentalogy, wherein the hero avenges his murdered family upon five bandit chieftains, one after the next. This is no mere rehash of *The Count of Monte Cristo*. Vance's imagination creates for us a rich and darkling future universe of many worlds, no two alike, each wholly strange yet wholly believable. His invention is no less fertile where it comes to incident. At the same time, the major characters have considerable depth and complexity, and their interactions, casual, comic, tragic, suspenseful, or chilling, show us a great deal about how we interact with each other in real life. Finally we have the narrative style; Vance is an absolute master of evocative language.

While these merits would more than justify the books on any terms, I want to point out that the series is unequivocal science fiction. The events it describes could only have happened in the exact setting the author has created. He is not selling us hand-me-down Dumas, but the clear quill, with more than our money's worth thrown in.

Many comparable examples could be given, but this ought to convey the general idea of what I mean by quasiscience. The question here is, "Does that kind of story have any proper relationship to

science itself? Does it not just borrow a few appurtenances—and most of these not directly, but from hard and imaginary science fiction—in order to get on with its own business?”

I think this is, indeed, often the case, but far from always. For one thing (since reality, even literary reality, never fits into our neat little categories) an essentially quasiscience story may embody elements of other kinds. To give a personal instance, my novel *A Knight of Ghosts and Shadows* is quasiscience, its focus on what happens to people, with no particular development of anything else. Yet not only does it include sequences on the planet Diomedes, which I'd years before made the subject of the hard science novel *The Man Who Counts*; the planet Dennitza was designed for this later story. The detail work is less visible because Dennitza is humanly habitable, thus its differences from Earth not always obvious, but they are there. Moreover, early in the book a key conversation deals with historical patterns and their repetition—the quantification of which is at least an imaginary science, and may someday become genuine.

If sociology is a legitimate science (which I don't deny, though from a physicist's point of view it's a primitive one) then the authors' homework takes quite a few tales out of the quasiscience and into the hard science class. For example, John Brunner's *Stand on Zanzibar* is firmly based on sociometrics. Besides plausible future technology, Jerry Pournelle in his writing employs a considerable knowledge both of history and of practical politics, as Robert Heinlein has always done . . . and I've mentioned Theodore Sturgeon's remark that one meaning of the word "science" is "knowledge."

The question of how a given work shall be classified is often uninteresting, because the answer must be arbitrary. Thus, Philip José Farmer's "Riders of the Purple Wage," besides being a gorgeous romp, was inspired by a serious study of economic and social trends in the real world. Most of Mack Reynolds' stories extrapolate from his acquaintance with various parts of Earth, as well as his reading in such areas as anthropology. Nevertheless, I'd place these—very honorably—in the quasiscience bracket, because that is where their emphasis seems to me to lie. If you want to disagree, be my guest.

In fact, the likelihood that some readers will disagree is important to me. Besides wishing to show the limitations of categories, I want to show that quasiscience, too, has by and large a relationship to science which is indissoluble no matter how mutable.

There remains my fourth class of theme, which I have dubbed "counterscience." This refers to the kind of story in which, seemingly, the author pays no attention whatsoever to science or its findings, unless a few of these suit his or her purpose.

Outright fantasy is an obvious case in point. We get gods and ghosts and what-have-you, with no attempt to rationalize them. Or so it appears; more on this in a moment. Let me first comment on an amusing detail. At the start of this series, I suggested that science fiction may be considered a subdivision of fantasy. Now I am suggesting that fantasy may be considered a subdivision of science fiction! For that matter, John Campbell sometimes maintained that all fiction is science fiction, with "mainstream" a specialized branch thereof. Al-

though I would not myself take such an extreme position, still, it is perfectly logical.

Thus literary classifications are "temporary scaffolding on which to walk around and look at the subject," as I phrased it in the essay where I originally defined these four types. Nevertheless, they can have that much usefulness.

The fact is that most modern fantasy *has* rationalized its supernatural elements. Of course, this is not in a gobbledygook way ("Shazam!") nor even in an imaginary science way ("the trolls are mutants, the wizards have psionic powers"). However, though the supernatural may be taken for granted, there's usually an assumption that it has its own laws, logic, and limitations. The underlying philosophy is not unlike that of the imaginary science story. This sense of basic realism is, I think, part of the charm of classics such as J. R. R. Tolkien's *The Lord of the Rings*.

I don't know how much of that attitude is due to Campbell. After well-nigh single-handedly bringing modern science fiction into being, he did found the fantasy magazine *Unknown Worlds*, which in its short but brilliant career published dozens of stories whose delight consisted largely of their reasonableness on top of outrageous premises. It's clear that there was no effect on Tolkien, who had been creating his own dream-world starting much earlier. Yet may this kind of science-influenced fantasy not have been "in the air," precisely because of the influence of science upon our culture as a whole?

It does appear that later fantasy writers who were not of the *Unknown Worlds* school either, e.g., Richard Adams, nevertheless developed them-



selves along the same lines. Tolkien turned out in the end to have been basically more archaic. There is nothing wrong with that, but a number of readers have expressed disappointment in *The Silmarillion* precisely because it is so thoroughly mythic. (Others find this glorious. My point is merely that some cultural bias toward rationalism persists, also in fantasy, doubtless due to the pervasiveness of science.)

With this much said about the use of "ghosties and ghoulies and long-legged beasties and things that go boomp in the night" in our era, I need only make a few brief remarks about the sort of counter-science story which is nominally science fiction. It is the kind which uses any conceptual apparatus, such as spaceships, that may be convenient, but ignores any facts that are not.

The most famous case is Ray Bradbury's *The Martian Chronicles*. Even at the time the author was writing, it was known that Mars could not be anything like the world he described, nor could expeditions there have anything like the character he showed. Bradbury realized this. He just didn't let it stop him. The results were splendid. Never mind that he paid no attention to physical details. He paid it to language. Elsewhere in this series I have mentioned James Branch Cabell, another favorite of mine, as deliberately bypassing science and logic in order to "write perfectly of beautiful happenings." There are others more recent, including Leigh Brackett, Harlan Ellison, and Roger Zelazny, rightly honored.

For present purposes, this school has a significance of its own. Here, within science fiction itself, we begin to touch the limits of the influence of

science on literature. At most, extreme counter-science stories draw a certain amount of imagery from science—except that it is outmoded imagery, a cosmos long superseded.

Let me re-emphasize that that has nothing to do with the value of the literature itself, nor is it in any way illegitimate. Shakespeare also employed an antiquated world-view. I don't see any intrinsic trend toward antirationalism in counterscience stories. Even such a lifelong rationalist as L. Sprague de Camp has written his share, as well as other kinds. For the most part, counterscience is merely one more vehicle for the imagination.

There is some reaction against science within science fiction, and we'll have to come back to that, but first we must look elsewhere.

For we do have a strong and ominous antirationalistic movement in the real world. We have come far indeed from the serene faith in reason and reasonableness that marked the Edwardian Enlightenment. When millions of educated people openly believe in astrology or in the ridiculous "Bermuda Triangle," it's one symptom of a disease whose more virulent manifestations include widespread political lunacy.

Nazism was an unmistakable instance of that. Let's bear in mind that it prevailed in what had been one of the most civilized countries on Earth and a fountainhead of scientific progress. Besides its cruel racism, Hitler's government made thought subordinate to a mystique of "blood and destiny" and, not so incidentally, encouraged any number of nutty pseudosciences such as Hörbiger's *Welteislehre*. Yet Nazism was, historically, derived in large part from Marx (National Socialism, re-

member?) and it organized Germany along lines closely parallel to Stalin's Soviet Union. The similarities include not only censorship, secret police, and concentration camps, but range from the chaotic structure of the bureaucracies—no clear chain of command—on down to styles in art and architecture.

Now Stalin's régime was not an aberration, as has been claimed ever since Khrushchev's famous speech denouncing it. Rather, Stalin proceeded along lines Lenin had followed from the beginning. Communism claims to be scientific, but the scandal of Lysenko, to whose notions Soviet geneticists and agronomists were long forced to conform, is only the best-known among many. For another example, in physics, relativity was rejected because the Party decreed on ideological grounds that space must be of infinite extent. To this day, despite a measure of liberalization, some Soviet cosmologists admit to feeling uncomfortable with the idea of a closed universe, one that goes through cycles of expansion and contraction, because it negates the linear progress that Marx proclaimed.

Indeed, the assertion that he founded a real science of history—that we have, so to speak, already had our Hari Seldon—is itself scientifically preposterous, as a glance at the career of Marxism in theory and in power will show. Nevertheless, untold millions of literate, intelligent people, very few of whom are villains, believe this.

The list of official irrationalisms would fill a depressing book. Heaven knows that the Western world in general and the United States in particular have developed their share. It isn't my purpose here to launch partisan political arguments. I sim-

ply point to the fact.

Likewise, we needn't go into detail about the growing popularity of mystic religions, most of them imported. (This may in part be due to Christianity and Judaism having evolved rational theologies. Even in them, however, we observe movements away from reason: for example, the Moon cult or the practice of glossalalia.) Nor need we do more than remind ourselves of witless diatribes against "plastic" and of earnest attempts to go back to a natural way of life that never was.

In science fiction, too, we are seeing a certain amount of antirationalism and technophobia. They aren't new, of course. The early magazines were full of mad scientists and Things Man Was Never Meant to Know. On a rather higher level, *Brave New World* is technophobic, i.e. it preaches that there is something inherently destructive about advanced science and technology and their social uses. Later, science fiction became dominantly rationalistic and technophilic, but about twenty years ago a drift back grew manifest, perhaps at first in some of the "psionics" stories but presently in other kinds.

Because of the still considerable prestige of science, as well as the fact that it has provided us with much of our current idiom, many aberrations wear the trappings of it, or borrow from science fiction. "Flying saucers" are just one example.

Now why should this be? Why should the basic philosophy of science be denied by more and more of the very people who have benefited most from the technological progress its findings have made possible, and who should be most able to appreciate the power and beauty of those findings?

I have no ready answer, and can but suggest a

few possibilities.

The catastrophe of World War One was spiritual as well as physical. Suddenly Western civilization saw its own governments, all its institutions, go mad. The first Battle of the Marne should have shown that a compromise peace was imperative, but instead, the slaughter went on for four years, with destruction and suffering to make the Napoleonic Wars look like a picnic. Democracy, that most rationalistic of political systems, not only collapsed in many countries as a result, it had had much to do with making the conflict so terrible. Disillusionment helped turn nations toward more primitive arrangements, whether the strong-arm dictatorships called Rightist or the messianic quasi-theocracies called Leftist.

The modern technology on which we depend seems to require organization on a huge scale. Perhaps this isn't true, but it is the way things have worked out. The sense of depersonalization, of being a mere cog in a machine, must lead many individuals to seek elsewhere for something to make their lives feel meaningful.

More and more, we are becoming conscious of the side effects of that same technology, pollution, depletion of resources, destruction of nature, threats to life. Those who have a little sophistication about such matters see, also, that our technocrats are as fallible as our politicians. That's a scary thought, when without functioning machines most of the human race will die. This includes even backwoods peasants; the world has become that close-knit. (Roberto Vacca, an Italian engineer, goes so far as to maintain in his book *The Coming Dark Age* that collapse is inevitable.) Nuclear weapons

and other implements of mass killing are unpleasant products of today's technology. So are things like bugging devices and computerized records, which make us seem helpless before Big Brother. Under these circumstances, a passionate recoil is understandable.

My friend F. N. Waldrop made an interesting suggestion in a conversation not long ago. As science gains knowledge of how humans work as organisms, the area of determinism grows. Emotions turn out to be matters of chemistry, the brain is closely analogous to a computer, the clinical distinction between life and death becomes arbitrary, life itself appears to have arisen as still another physical phenomenon which we are beginning to understand in detail, the Skinner school of psychology even denies that a word like "consciousness" has any meaning. No matter how fascinating from an intellectual standpoint, or how valuable to medicine and other humane work, all this offers ever less emotional nourishment—except, of course, to those few who find intellection and discovery high-order emotional experiences. It's no wonder that many others turn away in search of a more reassuring world-view.

Finally (though I have by no means mentioned every conceivable factor), it is possible that our species, genetically no different from its Upper Paleolithic ancestors, simply cannot maintain a high level of rationality for long at a time.

Yet the scientific perspective is incomparably marvelous, not least because it includes a still widening horizon. It functions in most ways like a mythology, but no recognized mythology is as rich or confers as much power, for good as well as ill.

We may still dare hope. Around the world, democracy is in retreat, but it is not yet extinct and it may resurge. Moreover, granting its flaws, it may not be the end product of social evolution. One can at least imagine successor orderings which will be better, such as libertarianism. Meanwhile, we aren't absolutely doomed to be swallowed up by vast organizations. Indeed, the productivity of industrial civilization makes possible a degree of individualism that could never have been before—a point I tried to make in *The Byworlder*, but which has long been clear to anyone who has spent a while in a modern city and kept his eyes open.

Science-based technology does not have to destroy life on Earth but can, instead, become its savior. Nature herself is grossly careless; far more species are dead than alive, and this was true long before humankind emerged. It wasn't agrobusiness which made a desert of the once Fertile Crescent, it was peasants with wooden plows. Aristotle commented on how the deforestation of Greece was leading to soil erosion. Without science, we'd be a less rapidly destructive force, but there would be no end to it short of our extinction. Lately we have begun to understand a little; "ecology" is a word of twentieth-century origin. We have begun to take a few measures. Much deeper comprehension and much more thorough reform are necessary, but they are also possible.

Energy crisis? We haven't any, unless we insist on creating one for ourselves. No doubt a difficult period lies ahead, but with common sense and enough scientific-industrial effort, we can pull through, and come out at the other end with virtually unlimited energy sources. Most of what we're

hearing to the contrary nowadays is just the latest rhetoric of the collectivists, who feel that it's somehow wrong for people to be free, and the neo-Puritans, who feel that it's somehow wrong for people to be rich and happy. As Jerry Pournelle has observed, the "limits to growth" ideology is not only false, it's savagely racist; it would deny to the poor countries of Earth any chance of ever rising out of poverty.

We do need to organize our technology along more sensible lines, and we do need to resist and roll back the encroachments of the state upon us, with special reference to the new means it is developing. These two efforts go together. Though free people remain humanly fallible, sometimes humanly nasty, their societies have self-correcting and fail-safe features not found in any other kind.

As for spiritual starvation, it isn't an inevitable consequence of science either. Instead, as I remarked a while back, to many of us the scientific vision by itself is exalting enough. For those who want something else, religion can be rational as well as emotional; see Thomas Aquinas, Moses Maimonides, and any number of other thinkers within a wide variety of beliefs. Given their civil liberties, people can also create their own emotionally satisfying institutions, whether these provide color and ceremony or stronger bonds. As for the latter, a revival of close family life and personal ties is not impossible, though neither is it the only imaginable way.

None of this optimism may be realized in fact. At present the odds look against it. For that matter, as we've seen, the rationalism which is the heart of science appears to have its own limits. Certainly



science requires a great deal of pure faith, in every sense of that word. And ultimately, what we confront will always be mystery.

Nevertheless, we have witnessed something of what the inquiring and reasonable mind can accomplish. To some extent, science fiction has celebrated that. Once in a speech I called it the tribal bard of science. The metaphor can stand even today, because bards did not always chant praises. Sometimes they called for reform, or they mocked, or they incited to rebellion. I would be the last to tell any colleague what he or she must write. My point here is simply that science fiction has always had a living relationship to science, perhaps more intimate and complex than we have realized.

Most science fiction continues friendly to rationalism and technology. It isn't usually fervent about this, because tales don't usually demand that their authors preach a sermon. However, the opposite attitude is expressed in comparatively few narratives—which, by the way, seem to garner less than their share of awards. (Let me repeat, this is not to put down this class, which has included brilliant works and which, in any event, we need as medicine against *hubris*.) It's plain to see that I am a technophile and something of a rationalist, who thus finds science fiction to be a small but real force for good.

You may disagree. If so, no matter. My only purpose in these essays has been to explore a relationship. There remains much else to discover, but let others who are inclined have that pleasure. Myself, I have stories yet to tell.

First, though—uh, Jim, you said something about another drink? ●



